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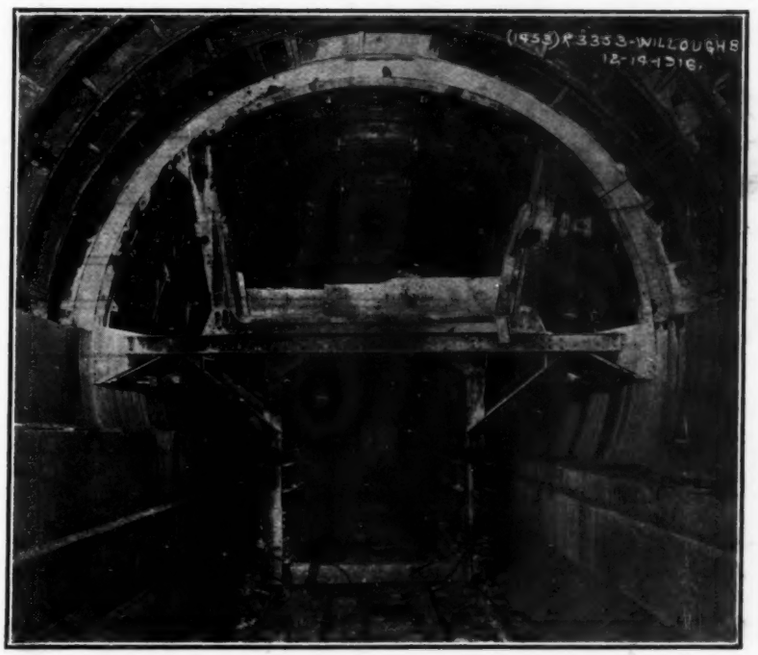

ARCH FORM AND TRAVELER. SIDE WALLS AND DUCT BANKS COMPLETED AND ARCH SECTION CONCRETED OVER FORM

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NOVEMBER 20, 1920

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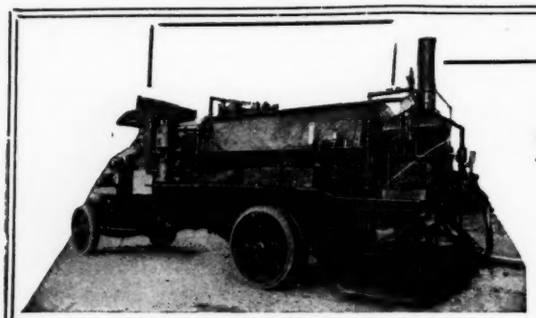

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Vol. 49 FLORAL PARK, NOVEMBER 20, 1920 No. 21

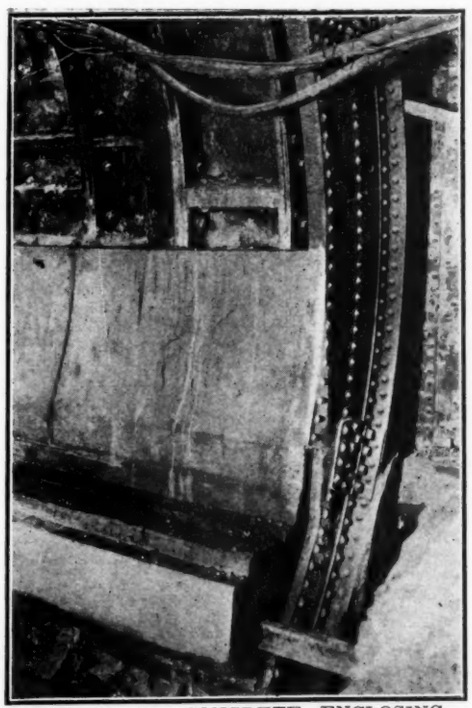
Concrete Lining for Cast Iron Tunnel Shells*

Steel forms, travelers, and concreting operations in the four tunnels under the East river, New York. Difficulty experienced in setting forms on curves and to provide for variations from line made in driving the tunnel. The concrete lining was placed in six successive operations.

The four double-track subway crossings of the East river, New York, at 60th street, at 14th street, at Old Slip and at Whitehall street, involved the construction of about 61,100 linear feet of single-track tunnels, including 17,500 feet of cast iron tubes driven by the shield method under the river bed and adjacent to it which, after completion, were lined with concrete having, in the arch, an average thickness of about 14 inches, and extending about 6 inches beyond the projecting ribs of the cast iron segments.

The circular inner surface of the arch concrete has in general a diameter of about 15½ feet. Below the springing line the horizontal clear width of the finished tunnel is diminished by the construction of the duct benches which in cross-section have rectangular offsets extending down with vertical faces to the horizontal invert concrete on which the track is laid.

The total concrete involved in the tunnel lining amounts to a little more than two cubic yards per linear foot of single track, and is nominally, as stated in the previous article, proportioned 1:2:4 of cement, sand and gravel up to ¾-inch diameter It was mixed in drum machines located at the feet of the shafts and, excepting a small quantity handled by the pneumatic conveyor system, was delivered by dump cars drawn by electric mine locomotives to the points where used.



SIDE WALL CONCRETE ENCLOSING DEEP RIBS AND FLANGES OF CAST IRON SEGMENTS

ADJUSTMENT OF FORMS

One of the most essential functions of the concrete lining was to provide additional insulation for the third rail, which required a minimum of at least 1 inch and preferably 2 inches of covering. Owing to the impossibility of driving the tunnel, in shield excavation, with exact accuracy, the alignment of the cast iron lining varied somewhat and difficulty was experienced, on the sharp curves, in setting the forms so as to overcome the irregularities, clear all of the projections and give a sufficient body of concrete to properly enclose the projecting ribs of the cylindrical segments and the angle of the duct banks. The rigidity of the heavy forms made it difficult to spring them, and the entire length had to be adjusted, causing more labor and delay than would have been the case with a flexible construction more easily adapted to local variations.

On tangents the variations were overcome in some cases by raising the entire traveler or by shifting the tracks, and in some cases slight

*Part I, Mixing and Transporting Concrete, was published September 18, page 247.

changes of alignment were found necessary. After they had been made, the forms were adjusted without difficulty except on the curves of 275-feet and 300-feet radius, where special forms, 20 feet long, were made curved to the required radius. Before these were provided considerable difficulty had been experienced in trying to force the regular forms into position by wedging, jacking and other difficult operations.

Wherever there was any eccentricity between the forms and the lining, the reduced clearance on one side impaired the efficiency of spading and made it more difficult to insure maximum density of concrete and particularly hard to force the concrete up against the stiffening ribs and flanges of the cast-iron segment, where some voids occurred that were subsequently filled with grout.

CONCRETING OPERATIONS

The concrete lining was placed in six successive operations, as shown in the cross section, which, although for a tunnel in rock without cast iron lining, gives the correct method of placing the concrete in all tunnels of this work; the limits of the courses; and the order of the operations indicated by the joint marks and by the sequence of the numerals. The drawing is also of interest in that it shows the special lead sheet introduced at all expansion joints, 25 feet apart, to prevent the possibility of leakage through the construction joints.

Concrete for the invert, with a horizontal upper surface about 6 feet wide and depth of about 19 inches at the center point, was, in the first operation, dumped in position in the bottom of the tunnel without forms and the upper surface was screeded to a horizontal in lengths of about 100 feet by 15-man gangs advancing about 80 feet per eight-hour shift.

In the second operation, sections number 2 on opposite sides of the tunnel, called the aprons, were made in light wooden forms through which the concrete was delivered from cars operating on the preliminary high level track. When this concrete was several days old the 24-inch service track, on which spoil and materials were handled by electric mine locomotives, was laid on the center line of the invert and a 6-foot track was laid there concentric with it, on which were operated the travelers from which the concrete was delivered for the remainder of the lining, which was built in Blaw steel forms.

The concrete for the second courses was deposited behind wooden forms made in short sections that could easily be lifted by hand. The horizontal lagging boards were nailed to vertical ribs about 12 inches apart that were notched at the lower ends to offset the apron course and were fastened to top and bottom longitudinal pieces against which inclined braces were set, holding them in place and still giving clearance for the tunnel cars and locomotives.

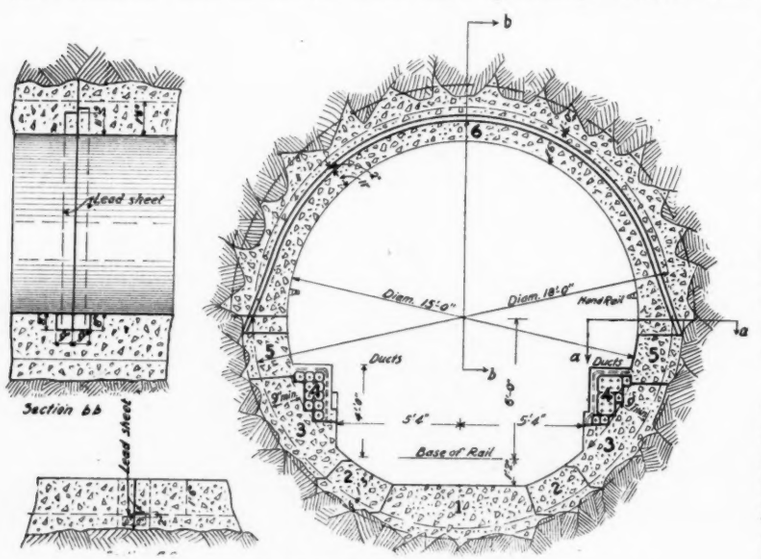
In the third operation, the duct benches were built up to about 4 feet above the top of the invert and to the bottom of the duct tiles.

In the fourth operation the duct tiles were laid in cement mortar, with slightly different arrangement on opposite sides of the tunnel.

In the fifth operation, the banks of duct tiles were enclosed in concrete which protected the tops with a horizontal surface forming a narrow sidewalk and was continued up above it 3 feet at a curved side wall reaching to the spring line. The steel forms in which this course was concreted were stiffened by wide vertical transverse plates, making a frame-work suspended from the overhanging caps of the traveler and adjustable by turnbuckle struts by which they were moved out horizontally to the required position for receiving the concrete, or were withdrawn transversely from it, thus stripping the forms from it after it had set.

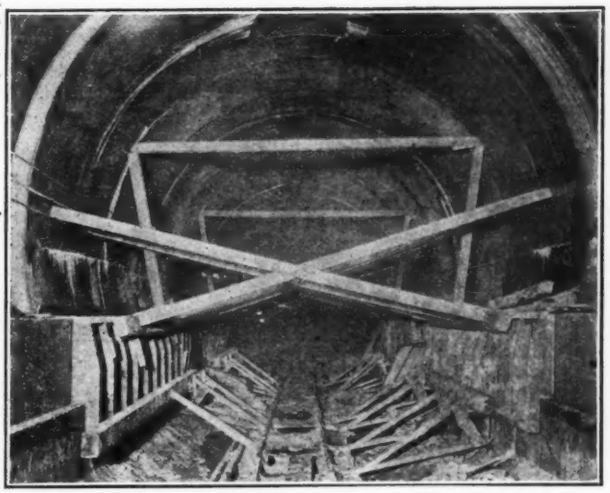
In the sixth operation the arch concrete was shoveled into place between the permanent cast iron lining and the semi-cylindrical steel forms, which consisted of curved plates put in position from the bottom up as the work advanced and supported on transverse steel ribs braced together to form units 20 feet long. These units were supported at the ends and at intermediate points on the transverse caps of the traveler and were set to receive the concrete or stripped from it by the adjustments in the supports. Usually five units were used together for the construction of 100-foot lengths of lining, which were concreted by a 15-man gang in from two to three eight-hour shifts.

The form travelers were built with several bents of vertical posts framed to top and bottom longitudinal sills and carried, in each bent, horizontal transverse caps that overhung at each end and supported the working platform or the concrete forms or both. Between the vertical posts and under the caps, there was



SEQUENCE OF CONCRETING OPERATIONS SHOWN BY NUMERALS AND RADIAL CONSTRUCTION JOINTS

sufficient clearance for the material cars and locomotives handling the spoil, concrete and other supplies and materials, thus enabling the concreting to be carried on without obstructing other tunnel operations.



FORMS AAD BRACING FOR DUCT BANKS

Lake Michigan to Gulf of Mexico by Water

Among the many projects for canal construction being advocated in all parts of the country, one of the more ambitious ones is that of linking the Gulf of Mexico with Lake Michigan by means of the Mississippi and Illinois rivers, supplemented by river improvements and canals. The last link in the chain of the canals and river locks necessary to complete this project has now been contracted for, this being the locks at Marseilles, Illinois.

New Sewage Treatment Plant of Okmulgee

By A. H. Kindrick*

This is the first plant to be constructed and operated under the new sanitary law of Oklahoma. It consists of a pumping plant, Imhoff tanks, dosing tank, sprinkling filter, and sludgs beds for a million gallons a day.

The rapid growth of cities and towns in Oklahoma, where the provisions for sewage disposal have not kept pace with the increase in population, is causing serious pollution of the water courses in the state.

According to the report of J. W. Evans, former engineer for the State Board of Health, sixty-three out of one hundred and ten sewer systems had at one time been provided with some kind of a treatment plant. Very few of the plants, however, were capable of producing good results and many of them were abandoned after a brief period.

At the present time, judging from reports and from the writer's own observation, 90 per cent of the sewage, from a connected population of over one-half million, is discharged into the streams either directly or after passing through a treatment plant, which, to quote Mr. Evans, "does not do the sewage much harm."

Sanitary Laws. In 1917 the State Legislature of Oklahoma passed "An act to preserve the purity of the waters of the state." By the provisions of this act, all plans for sewer systems and sewage disposal plants thereafter constructed must have the approval of the engineer of the State Board of Health.

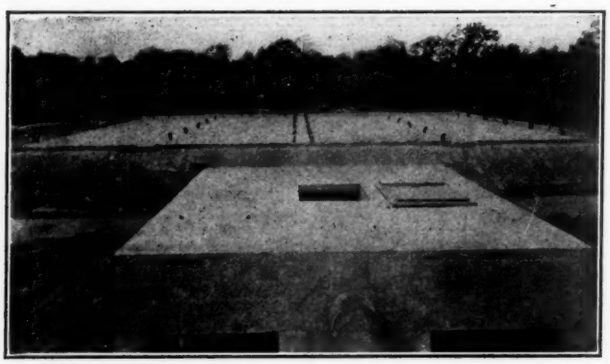
Okmulgee is the first city in the state to complete and put in operation a sewage treatment plant in compliance with the new law.

*Supervising Engineer of Burns & McDonnell Engineering Company

History of Okmulgee Improvements. The history of sewer improvements in Okmulgee, until the beginning of the new work, is typical of other towns throughout the state.

Okmulgee, with a population of 17,430, lies in a valley drained by Okmulgee creek, which flows south through the center of the town and empties into Deep Fork of the Canadian river. As early as 1904, Okmulgee, then a town of about 2,000 inhabitants, built water works and sewers and constructed a septic tank some distance beyond the town limits. Both the water and sewer systems were extended from time to time until the town grew out and around the site of the septic tank, which became filled with sludge and was abandoned. An outfall sewer about three miles in length was then laid to carry the sewage to Deep Fork. This sewer, a 12-inch pipe, with the influx of population due to the oil industry, was soon overloaded. Sewage from the overloaded out-

PUMPING STATION AT LEFT, IMHOFF TANKS AT RIGHT



DOSING CHAMBER IN FOREGROUND, SPRINKLING FILTERS IN REAR

fall was flowing into the creek within the city limits and other outfalls were discharging just outside the lower part of the town at the time the new improvements were begun. After securing the approval of the engineer of the State Board of Health to the plans and specifications, contracts were let in September, 1916.

NEW SEWERAGE SYSTEM

The principal feature of the sewer extensions is an intercepting sewer of twenty-one-inch pipe and smaller sizes to collect the sewage from the overloaded old system and provide drainage for new mains; and a new outfall twenty-four inches in diameter. There are at present thirty-five miles of main and lateral sewers connected to this outfall. The grade of the outfall is 0.12 per cent, but even this light grade is greater than the fall of the creek. It is, therefore, necessary to raise the sewage by pumping in order to carry it through the treatment plant and discharge the effluent into the natural drainage.

The plant site consists of six and one-half acres of level ground on the bank of Okmulgee creek about one and one-half miles out of town.

Pumping Station. The pumping station is a brick superstructure over a reinforced concrete pit. The building is 19 feet wide by 25 feet 4 inches long; the pit is divided longitudinally by a water-tight wall into a screen chamber and a dry pump pit. The sewage enters the screen chamber seven feet below the natural ground level, where it passes through an inclined bar screen with ¾-inch openings. There are three vertical centrifugal pumps each with a capacity of five hundred gallons per minute. One pump operates continuously through the night; two are in use during the day and a third is in reserve or used during unusually heavy flows. Each pump is driven by a seven and one-half h. p. motor set in the motor room above the pit. The motors are automatically started and stopped by electric switches operated by floats in the screen chamber.

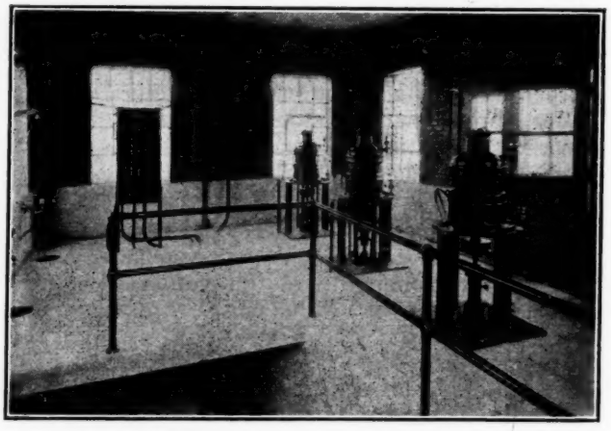
Imhoff Tanks. The pumps lift the sewage into two Imhoff tanks where the normal sewage level is twelve feet above the original ground surface. The two tanks are built side by side as one rectangular concrete structure 37 feet 2 inches wide by 73 feet 6 inches long, outside dimensions, and 26 feet from the top of the gas vents to the bottom of the hoppers. The outside walls are vertical down to the sludge hopper and are of the buttress type. The tanks are each 17 feet 6 inches by 72 feet, inside, and the sewage depth is 22 feet. Each tank is divided, lengthwise, into two settling compartments, over a common sludge chamber, with a 6-inch slot between the overlapping sloping walls. A continuous gas vent 2 feet wide is left between the settling compartments and one foot wide between the settling compartments and the tank walls. For the convenience of the operator, walks are built on top of the division wall and also on each side of the central gas vent in each tank.

The two tanks have a combined settling capacity of 97,000 gallons and a sludge capacity of 14,000 cubic feet. The tanks are designed to treat 1,000,000 gallons per day with a detention period of two hours. The tanks are arranged for either direct or reverse flow, suitable stop boards being provided in the channels and removable plates in the inlet (or outlet) weirs. Scum walls extending eighteen inches below the sewage level are set two feet inside the tanks across each end.

Sludge Beds. Two sludge beds, each 40 feet by 80 feet, are located one on each side of the Imhoff tanks, with space for future extensions. The sludge bed construction consists of low concrete walls within which is a level bed of sand six inches thick underlaid with drain tile bedded in gravel.

Dosing Tank. The effluent from the Imhoff tanks flows to a hopper-shaped dosing tank equipped with an eighteen-inch siphon, set for discharging when the effluent level is within three inches of the sewage level in the Imhoff tank and has a draw-down of five feet.

Sprinkling Filter. The filters are designed for a flow of three-quarter million gallons per day to operate at a rate of two and one-half million gallons per acre per day. The maximum head on the nozzles at siphon discharge is eight feet and the minimum is three feet. The filter bed is composed of the very hard and non-impervious Joplin flint, ¾ inch to 2½ inches in size and averaging 5½ feet in depth. The underdrain system is 6-inch split tile laid open side down in parallel rows ten inches apart on a concrete floor which slopes to the main drains. The main drains are gutters of 15-inch split tile. Vent chambers are con-



INTERIOR OF OKMULGEE SEWAGE PUMPING STATION

structed at the ends of the tile drains. Eight-inch sewer pipe risers reach from the vent chambers to above the filter walls, with elbows turned to catch the breeze from any point of the compass.

Care and Operation. Unlike many towns, Okmulgee is prepared to protect and care for its investment. The grounds have been fenced with a high and strong woven wire fence. The embankments have been sodded with Bermuda grass, and an operator is employed to give the plant constant attention.

Some trouble was experienced at the outset in the operation of the pumping plant due to stoppage of the screens on the suction pipes. This stoppage was found to be caused by cotton waste from garages and machine shops. An auxiliary screen was put in outside the building where the coarser refuse is disposed of. The operator now has little difficulty, after cleaning both bar screens, in keeping the suction lines clear.

Foaming over in the gas vents in the Imhoff tanks occurred once, but after thoroughly breaking up the scum and reversing the flow it stopped and has given no further trouble.

The plant is producing a very clear and stable effluent and there is no offensive odor in its vicinity.

The operation of the plant is under the direction of T. P. Paxton, Assoc. M. Am. Soc. C. E., commissioner of public works of the city of Okmulgee.

The plant was designed and construction supervised by Burns & McDonnell Engineering Company of Kansas City, Mo.

Mosquito Extermination at Greenville, Texas

The city of Greenville on September 24 passed an ordinance declaring mosquitoes and the breeding of them a nuisance and fixing penalties for certain specified offences in connection with the breeding of mosquitoes. Because of the annoyance and danger created by the mosquito, the council passed this as an emergency measure, to take effect immediately upon its passage.

The ordinance creates a mosquito district, which includes all of the city and for a distance of 5,000 feet beyond the corporate limits. It defines as a mosquito breeding or propagation place any collection of water in which mosquito eggs are laid or deposited, mosquito larvae or mosquitoes are grown and developed, including "any can, vessel, barrel, gutter, ditch, basement, pool, reservoir, cistern, low place, hole, sewer or anything or place holding water where mosquito eggs are or may be laid or deposited." Any such places are declared to be a nuisance and it is made unlawful for any person owning, occupying or in charge of any premises in the district to permit such breeding places to exist. Proper means and precautions must be taken to prevent such breeding and it is unlawful for owners of such property to fail to destroy all mosquito eggs and larvae on his premises. Wire screening of not to exceed 16-mesh must be placed on openings to cisterns, including gutter openings, on water barrels, vessels or conductors which hold water. Owners must cut and destroy all weeds or other vegetable matter about every collection of water on their premises where mosquito larvae can hide. Also weeds or grass in which mosquitoes can hide.

Other means suggested in addition to screens and cutting grass is to stock all water in basins or other depressions in the ground with what is known as pot-belly minnows, cut the grass along the edges of the water and keep the surface of the water free from floating vegetation. Where the water is not intended for use, it must be removed from its container within five days after collecting there or the container be filled with earth so as not to retain water; or failing this, the water shall be kept covered with kerosene, crude oil or any other product of petroleum answering the same purpose.

Fines are imposed of not less than $5 nor more than $200 for each offense, each day being deemed a separate offense.

Street Work in Fitchburg

Cost of cleaning streets. Patrolmen, pick-up sweeper and motor flushers used. Oiling streets. Assessing sidewalk costs.

Last year the street division of the Department of Public Works of Fitchburg, Mass., owned and maintained 24 horses, 6 new horses being purchased during the year and some of the older ones disposed of. On the basis of three hundred working days a year, the cost per horse for hay, grain, straw, shoeing, harness repairs and stable repair was $2.29 per horse per day, an increase from $1.26 in 1916, the increase of 82 per cent being due to the higher cost of labor and supplies. Hired double teams are paid $1 an hour, and it is estimated that, with the cost of supplies and labor as they are now, it makes little difference to the department from a financial point of view whether teams are owned or hired.

In his annual report, David A. Hartwell, Commissioner of Public Works, says that with motor trucks much more could undoubtedly be accomplished in some lines of work than with horses, but "with the amount of snow to be cared for during a usual winter it is probable that the department will never be able to do without horses."

The expenditures for street maintenance during the year 1919 totaled $103,144, of which the largest item was $22,096 for street and road repairs, and the next largest item was $17,965 for cleaning streets. All the other items were under

$10,000 each. Cleaning streets includes the work of patrol men on the principal paved streets in all sections of the city, one point so cleaned being three miles from the city hall. The collecting and removal of leaves in the fall months is a large item of cost.

An Elgin motor-driven pick-up street sweeper was purchased during the year, the cost of which was charged to the street maintenance appropriation. "The difficulty in securing a competent operator who was willing to stay hindered as successful accomplishment of results as might be possible. This machine does excellent work on smooth pavements and fair work on rough pavements. The early sweeping each morning of the principal retail business streets before much traffic started aided the patrolmen in keeping the streets cleaned."

For some years past a trolley street sprinkler and flusher was used at a cost to the city of about $4,000 a year. This was, of course, limited to the streets having car tracks and was somewhat objectionable when there was much traffic on the street, and Mr. Hartwell decided to discontinue this service and instead use the Elgin sweeper to supplement the work of the patrolmen. This plan has been so satisfactory that there has been no complaint from dust on the paved streets even though very little water has been used for sprinkling.

Says Mr. Hartwell, "I believe that the time is not very distant when work of the patrolmen and the Elgin sweeper should be supplemented with a motor-driven flusher. I say supplemented, for I believe that all street dirt so far as possible should be picked up from the street surface and not flushed into the catch basins. The cleaning of catch basins is an expensive matter and such work should be minimized."

Prior to 1919, dust laying had been paid for partly by assessments levied on the abutters, but last year the council decided to have all watering and oiling done wholly at the expense of the general public, and also to eliminate use of water for dust laying almost entirely, using oil instead. It is concluded from the experience of this city that oil is much preferable to water for laying dust; that making two applications during an ordinary season not only keeps the dust laid but also is a substantial aid in keeping streets in repair, as the oil prevents a large amount of the erosion in times of heavy rain. Twenty tank cars of oil were purchased and applied during the season. The total cost of oiling was $10,600.

Sidewalks are constructed by the city and one-half the cost levied against the abutting property. The general policy last year was to use cement for walks on streets where there is little grade and tar compound on streets having steep grades and also for extensions of walks already built of that material. The sidewalks are maintained by the city, the average amount expended annually for ten years preceding the war having been $5,500. In 1919, the amount spent for this purpose was $6,431, but the average amount for the three years previous had been only $2,400. Mr. Hartwell advocates the spending of more money in keeping the sidewalks in good condition, believing that "it is much better to do a liberal amount of work of this nature as may be needed, rather than through neglect to be compelled to settle damage claims. The money spent in settling claims would much better be expended on sidewalk repairs and everybody would be more saisfied."

State Sues Jersey City for Water Used

The Court of Errors and Appeals of New Jersey has sustained a judgment of the Supreme Court for $22,885 obtained by the State against Jersey City for the use of water between the years 1912 and 1918 in excess of that which it had a right to use. The city claimed that it had obtained from the East Jersey Water Company the right to divert 50,000,000 gallons daily from the Rockaway river and that therefore there could be no recovery by the state until it had exceeded that amount. The court held, however, that there had been no evidence to show that the state had authorized the East Jersey Water Company to divert this amount and that consequently the company could not transfer that right to the city. This judgment was obtained under the act of 1907, which permitted the state to impose a license fee of not less than $1 per million gallons of water diverted by municipalities in excess of the amount that was being legally diverted at that time, which amount in the case of Jersey City was said to be 38,400,000 gallons a day.

Two days after this decision, the State Board of Conservation and Development granted to the borough of Wharton, N. J., permission to divert water from the Rockaway river for the public supply of the borough. The conditions made by the State Board of Conservation were that the borough pay to the state the license fee provided by law and that it divert not more than 500,000 gallons a day.

Safety of Proposed Seattle Reservoir Questioned

The city of Seattle, Washington, having announced that it proposes to construct a storage reservoir in a park on Capital Hill, north of the present reservoir, residents in the lands below the proposed site have begun court proceedings to prevent this because of the danger to life and property which they claim such construction would create. Professor Louis Carpenter, of the University of Colorado, after examining the site, testified that he found on the site of the proposed reservoir a clay and gravel formation saturated with water and giving abundant evidences of springs on the hillside; also that there was evidence of work of burrowing animals. In view of these conditions he considered that it would be unsafe to construct the reservoir at the site selected.

The St. Louis Sewer System*

By W. W. Horner†

History of the development of the system during about seventy years. Present problem is relief of old trunk sewers. Early run-off formulas are not now satisfactory. The cost of sewerage per acre has been steadily decreasing for fifty years past.

St. Louis was founded (about 150 years ago) on a sloping hillside, and the early city was only about four blocks deep and extended along the river. Its rainfall was carried off in the gutters, and was first enclosed in sewers across the levee, which was the scene of the city's most important development.

Back of this river front slope, the present city lies in a series of valleys, generally trending from west to east, and now includes a large part of the River des Peres valley, which circles the city on the southwest. As the city grew it spread westward up these valleys. This situation was of great advantage for the builders of the earlier part of our sewer system, as it was only necessary to sewer each valley to the extent of the city's development at that time, and the upper ends of the valleys being always rural, presenting no sanitary problem, and yielding comparatively small storm floods, permitted our development under almost ideal conditions. Thus for nearly fifty years our construction was a steady westwardly progress, paralleling the growth of the city, and each additional mile of main sewer indicating distinctly the progressive development in the art of sewer construction.

These early sewers were of two kinds—main trunk sewers, being built almost entirely of cut stone, with some examples of cut stone side walls, and brick arches. In soft ground, these had timber bottoms of extraordinary construction, in some cases consisting of twelve by thirty inch cottonwood logs thirty feet long, laid side by side. The smaller sewers were at first all built of brick, generally of an egg shape in the smallest sections, and circular in the larger ones. The minimum size of brick sewer was three feet high by two feet wide, and the greater part of our old city, east of Jefferson avenue, had sewers of this character, being two by three brick to the extreme ends. About 1870 some cement pipe was used, in sizes from twelve to twenty-four inches. This was discontinued about 1875 in favor of tile pipe, and the tile was used in increasingly larger sizes up to the present time, when thirty-inch is common, and thirty-six inch used.

Eventually, however, we have had to pay the penalty for our earlier advantage of progressive construction. Our progress reached the heads of the valleys and they were completely occupied. They were also completely sewered, but the systems were not comprised in a single engineering design as we would lay them out to-day. Instead, near the river in each valley there were old sewers, inadequate in size and flimsy in construction, and at the upper end modern sewers built, both as to capacity and strength, according to the best standards that we have been able to develop. The intermediate construction represented the gradual progress of the art of sewer design and building throughout the city's development. In the central portion of the city our progress passed over the ends of these eastern valleys into the valley of the River des Peres, and without providing any great improvement for that stream itself, we have sewered in detail much of the River des Peres valley out to our western limits. In the northwestern and southwestern parts of the city our development has now reached to the city limits, and is only now requiring the final sewering of these outlying districts.

Under these circumstances it is obvious that the great problem of sewer work today is the relief of the early trunk sewers and the east ends of the mains in each valley. A study of one of these systems would show portions based on widely different theories of design, and with the personalities of many city engineers and designers impressed on them. Some interesting records of engineering opinion along this line are preserved in the early reports. In 1852 the city engineer said, "I have constantly urged the reduction of our common sewers. I regret to see that private drains are generally made too large, and in midsummer I apprehend that they will be found unclean. It should be borne in mind that small sewers are stronger, cheaper, and more likely to keep clean. It is true they might be made too small, but we have in no instance so reduced the dimensions as to come below ample capacity. I have much reduced the size of the Seventh street sewer, but not until I had carefully observed the quantity of water and calculated the capacity of a sewer requisite to issue such a flood." He then goes on to explain at length the mathematical formula resulting from the study of the mechanics of flow. He ends by saying that "public anxiety may therefore rest assured that if sewers fail it will not be in consequence of their being made too small." It is interesting to note, however, that the engineer failed to visualize the city which was ultimately to be served, and most of his sewers have now from thirty to forty per cent of the required capacity.

*Slightly abbreviated from a paper before the American Society for Municipal Improvements

†Chief engineer, Division of Sewers & Paving, St. Louis

During a later development, Mr. Robert Moore evolved a new table for sewer design, in which the sewers were to carry off one inch of water per hour, and at no time to run over three-fourths full. He says, "This is equal to a natural rainfall of two to three inches per hour, depending upon the declivity and the character of the soil." Compare this with our present design, providing for a runoff of from two to three inches an hour.

At a still later date, Mr. Robert McMath made careful gaugings of the flow of the St. Louis sewers, and developed the now famous "McMath Formula," which represented a great advance in sewer engineering, but which we have again been forced to discard in favor of the more satisfactory "Rational Method."

About 1885 the overcharge of the early sewers began to cause serious damage, and supplemental sewers were built in what is now the business district. In 1900 and in 1904 enlargements of the two main valley sewers, that is, the Mill creek and the Rocky branch, were carried out, but gave only temporary relief, and in 1910 and 1914 paralleling sewers were constructed to bring the total main trunk capacity up to the amount required under modern conditions.

In all of this later work there has also been a general change in the character of the materials of construction, concrete and reinforced concrete coming into use for large sections, making possible the carrying out of great projects at half the cost of the old massive masonry structures. The reinforced concrete sewers of the Harlem Creek system were probably the first extremely large sewers in the country, and the Harlem system, as a whole, probably still stands as the largest single reinforced concrete sewer, its sizes being from twenty-nine feet in horizontal diameter down to twelve, and the total length of the system in excess of seven miles.

The sewer problem in St. Louis, while complicated in detail, is fortunate in the absence of any disposal problem. The low water flow of the Mississippi river is forty thousand cubic feet per second, or over fifty cubic feet per second for each thousand of population at present The problem, therefore, is one of handling enormous amounts of storm water, and of carrying the sewage in the same conduits without creating offence. This can be appreciated from the capacities of the Harlem creek sewer and of the relieved Mill creek sewer, which in each valley will carry five thousand cubic feet per second. At the present time we are asking for funds to continue the enlargement of the earlier sewers, and to replace some of the original brick sewers which are now in dangerous condition. A bond issue of two and a half million for this purpose failed to carry this year by a very small margin, and undoubtedly an issue for a larger amount will be voted shortly.

Our problem of sanitation of the River des Peres valley is the largest and most complicated which we have yet had to solve, and any satisfactory solution involves very great expenditures. The flow of this stream in full flood exceeds the low water flow of the Mississippi river, and portions of the stream, which it seems necessary to carry in conduit, will have a flood flow of fully ten thousand feet per second. The plans for the work are complete and work will undoubtedly be begun in the next three years. The estimated cost of the whole project is $14,000,000.

The cost of our sewers has from the beginning been divided between the general public funds in the construction of public sewers, and the individual property holders in assessment by special tax. District sewers were paid for by bond issue guaranteed by the city, and refunded from the special annual tax, not exceeding fifty cents on the hundred dollar valuation. At a later date this was amended, and special tax bills for the full amount of the contract were issued to the contractor for collection. This latter system continues today, and while it absolves the city from any responsibility in its payment, it also makes the issue of tax bills particularly liable to contest and litigation, and their value has, therefore, considerably depreciated. A return to the earlier system, or of special tax bonds, would be an advantage.

The growth of the system, together with its cost, is shown in the following table. Of the area within the present city limits, 64 per cent is now completely sewered, and an additional 12 per cent is provided with main sewers. Of the 23 per cent unsewered, about 5 per cent is in parks, so it will be seen that the city is in a very satisfactory sanitary condition, our one great problem, as mentioned before, being the sanitation of the River des Peres valley.

Of the total cost of the sewer system to date 31 per cent has been paid from public funds, and the remainder taxed directly against the property.

TABLE I.

Year	Acres	Miles	Cost	Cost per acre
1855	400	18	$525,000	1310
1877	3720	180	$5,185,000	1390
1899	11,530	487	$9,248,400	802
1920	23,700	878	$23,512,000	990

The figures of cost per acre for sewerage are interesting in showing a steady decrease throughout the seventy years of the system's existence. The value for 1877, $1,390 per acre, is probably unbalanced, due to the fact that it came at the end of a period of very heavy main sewer construction, with a comparatively small acreage chargeable. Of the cost of the system to date, that is, $23,512,000, nearly five million dollars is chargeable to relief sewers, with which there was no corresponding additional acreage. If no relief sewers had been built, the cost per acre would now average less than $800. This simply means that with the demand for increased service, with the provision of greater capacities and more closely built areas, we have still been able to decrease our unit cost by the introduction of modern economical methods. These decreases are undoubtedly due primarily to the use of mechanical excavators, to the introduction of reinforced concrete in large sewers, and to the decrease, up to 1916, in the cost of factory made materials.

MAP OF THE CITY OF ST. LOUIS, SHOWING THE RIVER DES PERES AND OTHER SEWER DISTRICTS.

Water Supply for Private Land Development

A proposition has been made to the city council of Wilmington, N. C., by a land development company, that the company lay a distribution system through its property, to be connected to the city mains, and that the city collect the lawful water rates and turn them over semi-annually to the company until it has been reimbursed for the expense of constructing the system. In other words, the company would furnish the funds for laying the mains, and the city would purchase them by turning over to the company the water rents collected from the consumers along such mains.

This is a variation from the method which we believe is more common of having the mains laid by the city or water company, a certain annual percentage of the cost of such construction being guaranteed by the development company, which would furnish the balance, if any, between such annual rate and the regular water rates collected.

Hydro-Electric Power in Canada

Reference was made in a previous issue of PUBLIC WORKS to the attention being paid to the development of hydro-electric power in France and England as well as in this country. A recent report from Canada states that that country possesses the greatest per capita water power development of any in the world except Norway, having 19,500,000 horse power available, with a per capita development of 0.26 h. p., as compared with 0.54 h. p. for Norway and 0.07 h. p. for the United States.

In general, Canadian water powers are applied to three uses—municipal purposes, manufacture of pulp and paper, and electro-chemical and similar processes. Of the developed water power about 78 per cent is used for municipal, 14 for pulp and paper and 8 for electro-chemical or similar processes.

Locks and Dams for Sacramento Valley

The Sacramento Valley Development Association has decided to ask Congress to investigate the project of building canals and dams on the lower Sacramento river to serve three or more purposes, namely, to conserve and store water for irrigation, to prevent the tidal backing up of salt water to points where the stream is used for irrigation purposes, and to improve the navigation possibilities of the river.

Captain E. S. Jarvis, United States Army, suggested either a barrier across the Carquinez straits, or a dam across the bay from Port Richmond, estimating that the former would cost about $15,000,000, and would make it possible to store 800,000 acre-feet of water. All of those interested in the commerce and agriculture of this valley seem to agree that something is needed to improve both navigation and irrigation conditions, and the general scheme outlined seems to be the most feasible one suggested. The scheme is a large one however and will probably have to make progress somewhat slowly.

Reference has previously been made to a proposition by Robert B. Marshall that the state legislature appropriate a half million dollars for a preliminary survey and investigation of the water courses of the state with a view to formulating a fundamental state plan of water storage and distribution, which we believe is intended to include the Sacramento valley improvement above referred to.

Snow Plows for Massachusetts Roads

The highway division of the Massachusetts Department of Public Works, which will have charge of keeping open the highways of the state during the coming winter, has put it up to the truck owners to co-operate with the department if they wish to be able to use the roads continuously during the snowy season. The department has purchased 60 snow plows for use with heavy trucks and has secured fittings for attaching these plows to trucks of several different makes, but it looks to truck owners and freight shippers to operate the plows. The legislature appropriated $50,000 to the department for keeping open the roads, and it is apparent that this sum is by no means sufficient for furnishing and operating the trucks required for this work.

In addition to furnishing the plows, the state department will provide engineers to assist in arranging the work and supervising it when the actual plowing begins. Commissioner Cole has asked the truck users and owners of the state to notify him how many trucks they are prepared to supply for this purpose. Unless this is done and trucks are definitely assigned for each section of road beforehand and prepared to have the plows adjusted to them on short notice, there will be confusion when the snow arrives which must result in delay and probably greatly increase the difficulty of the work.

Missouri Good Roads Campaign

A caravan of army and navy trucks is touring Missouri with speakers that are urging the proposed $60,000,000 State bond issue for the construction of 6,000 miles of hard surface road without affecting taxes. The party contains a number of promient men of all political affiliations and is met with enthusiasm all along the route. The speakers are supplemented by moving pictures of road building in Missouri and by the American Army in France, and it is explained that the present yearly income of about seven dollars each for 300,000 automobile licenses in the state will suffice to take care of the interest on the bonds and that the reasonable increase of automobiles, which has been 125 per cent in the last year, may be expected soon to insure a net income of $3,500,000, which will be sufficient to retire the bonds and provide maintenance for the road.

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Deliver Materials Now For Next Years Work

In two of our recent articles describing road construction it was stated definitely that the rapidity of the work was due in part to absence of interruption caused by delay in receipt of materials, these having been delivered on the ground before construction began and drawn upon as a reserve. It is probable that a number of other instances where work was carried on with a rapidity and profit to the contractor this year, the ability to draw upon a reserve pile of stone, gravel, sand, cement and other materials played a very important part. These contractors were fortunate in being able to make their contracts sufficiently in advance of the construction season to permit utilizing the interval by obtaining and delivering on the work a part at least of the materials that would be required.

A year ago, we strongly recommended that the winter months be utilized in getting on the grounds such materials as it was practicable to obtain and deliver, and many contractors did this. One of the arguments in its favor was that the freight service of the railroads was most congested in the summer and least so in the winter and early spring, and that the contractors could therefore obtain better service from the railroads in having their materials delivered by utilizing this slack period. Unfortunately for many of the contractors, the condition which had prevailed during the season referred to before the war did not recur last spring, but, owing to shortage of open-top cars and unusual necessity for their use, in several sections of the country it was practically impossible for contractors to obtain any service of this kind from the railroads. It is to be hoped that they and others will not be discouraged this year by that experience. It is announced positively by many railroads that freight traffic is already slowing up and that their transportation equipment is fairly adequate for present needs and that a few weeks will find idle cars on the siding. In other words, so far as this condition is concerned, the railroad traffic is becoming more nearly normal and the condition anticipated for last year will actually exist this year.

In view of the advantage actually enjoyed by those contractors who were able to secure the early delivery of construction materials for this season's work and of the promise that railroad facilities will be such as to permit contractors in all sections of the country to adopt the same far-sighted policy, there would seem to be no question that every contractor who can obtain his contracts and arrange his work so as to do this, should begin delivery of materials early in the year of 1921.

This, of course, necessitates the securing of contracts not later than sometime in January, and this again involves the calling for bids for such work within the next few weeks. Officials of highway and other state and city departments will therefore be aiding greatly in insuring the completion of next year's construction program by at once preparing such a program and calling for bids upon it.

Licensing Engineers

The licensing of engineers by states appears to have become an established policy in this country. Only a few years ago there was considerable discussion and difference of opinion among engineers, and in engineering societies, as to the advisability of such licensing, and presumably such difference of opinion continues. But the fact that a dozen states already have laws requiring the licensing of engineers and architects seems to make it necessary for the other states to fall in line or else in all probability engineers who cannot qualify for licenses in states where such are required will

move into those states where licenses are not required; and if licenses are refused only to the incompetent, as they are intended to be, such results would be unfortunate for the non-licensing states.

This being the case, it is desirable that the license laws shall be the best possible from the point of view of both the public and the engineers. The Ohio engineers are, we believe, correct in thinking that a better law from the public's point of view, as well as from their own, can be prepared by engineers than could be prepared by lawyers or other non-technical men. Acting on this opinion, the Ohio engineers have drawn up a draft of a bill which it proposes to submit to the next legislature. The main features of this draft are given in this issue, and we recommend them for consideration by engineers and engineering societies in other states which have yet to adopt licensing laws.

Engineering Services by State Officials

The engineering division of the Illinois Department of Public Health "does not attempt to take the place of a consulting engineer but, on the other hand, always encourages the employment of competent consulting engineers by communities and then endeavors to assist the engineer in so far as its authority and duties will permit." This quotation from a circular recently issued by the Illinois Health Department has probably been called for by criticism which has been directed at health departments and many other state departments in the various states having supervision over engineering constructions and operations, that the engineers employed by the state perform gratuitously work which the engineers of the state in private practice rely upon for their incomes. It is a very nice question of ethics in the profession and of what is most for the public benefit. It unquestionably is not fair to practicing engineers that their practice should be destroyed by services rendered by public officials. On the other hand, it is to the vital interests of the public that supervision by competent state officials should be had over certain branches of engineering work, such as sewerage and water supply, which vitally affect the health of the people. The duty of a health department would, therefore, appear to be that expressed in the report just quoted from (which is abstracted in this issue), to stimulate public action to the point of employing competent engineers to do the work, and to pass upon the engineering, designing and construction work with a view solely to preventing the squandering of public money or the failure of such works to perform their desired function of preserving the public health.

Even more interference with the business of the private engineering practitioner is occasioned by professors in engineering schools doing private work of exactly the kind which is performed by engineers who make this their sole business. Possibly there could be little just criticism of this if the engineers who teach were not inclined to "cut rates" because they obtain a considerable part of their income from their college services. Certainly, whether or not it is proper for them to engage in private engineering practice at all, they should not compete with other engineers unfairly, offering their services at anything but the rates which the highest class of services is entitled to. From the point of view of the students in their classes, there is the further question of whether their private practice may not interfere with the full performance of their college duties. Some colleges encourage their professors to take on more or less private practice, believing that this keeps them in touch with practical affairs and prevents their settling down into old ruts, some colleges going so far as to employ part of the time of practicing engineers for instruction of their engineering classes. On the other hand, at least one or two colleges forbid their professors engaging in private practice at all. The question is a difficult one for solution so as to secure the best interests of all concerned. In this case, the public would not appear to be especially interested, but it is largely one of ethics of the profession, and as such would seem to be entitled to more consideration than has been given it by the various codes of ethics which have been prepared and promulgated from time to time by individuals and organizations.

Registration of Ohio Engineers and Architects

A committee of engineers of that state has drafted a bill and hopes to obtain the endorsement of it by all the state organizations concerned and to have it passed by the next legislature.

The matter of registering engineers, which was being advocated by a few some eight or ten years ago, has now become a reality in quite a number of the states and is rapidly being adopted in others. Information concerning such developments in Virginia and North Carolina were noted in our issue of October 30. Ohio engineers are expecting to obtain similar registration laws in that state next year. In preparation for it, some of the organizations of engineers in that state have, through a committee, prepared a draft of a bill which is being submitted to all of the engineering, architectural and technical societies in the state. This committee was originally appointed by Cecil L. Rood, as president of the Ohio Engineering Society, adopted by the Association of Ohio Technical Societies and endorsed by the Ohio Assembly of the American Association of Engineers. The tentative bill may therefore be considered as the proposal of those organizations, and copies have been sent to all other known organizations interested, with a request that they either endorse it or notify the committee of such changes as they think absolutely necessary and appoint a delegate fully instructed to meet some time in November to perfect a final draft.

In its report the committee says: "The issue has been put squarely up to us by the enactment of similar legislation by numerous other states

and the virtual barring out of Ohio engineers from at least one other state until such a law is passed." Another argument for the law is that men are elected county surveyors who do not even pretend to be engineers and yet have charge of bridges and highways. Such legislation will undoubtedly come in Ohio and the committee believes it wise to have it prepared by engineers and architects and fully discussed by technical societies, "rather than to take a chance on such laws as may be drafted by non-technical men." The bill covers both engineering and architecture, because "there is so much inevitable overlapping between these professions, and between the various branches of engineering, that most annoying and damaging complications cannot fail to follow attempts at separate regulation. This has been demonstrated in Illinois."

The bill provides that, beginning one year after its passage, it shall be unlawful for anyone to practice professional engineering, architecture or surveying, or to hold public office or employment involving the practice of such professions, or to set or disturb boundary monuments, unless such person regularly hold a certificate entitling him to practice professional engineering, architecture or surveying. A person holding an engineering certificate can practice architecture, and vice-versa, but a surveyor's certificate does not include the other two. Such certificate is necessary to permit a person to qualify as expert witness on these subjects in any Ohio court, and no map or plat of any land or mine will be accepted for record unless certified by a registered engineer or surveyor.

In the case of a corporation or partnership practicing engineering, architecture or surveying, all persons connected with it in responsible charge of design or supervision of work must be registered. Assistants not having responsible charge of work are not required to hold certificates providing they report directly to a registered engineer or architect who assumes all responsibility for their work. A person must be a citizen of the United States or Canada, or have made declaration of his intention to become a citizen of the United States, in order to receive a certificate.

The committee recognized that a satisfactory definition of the practice of engineering and architecture is practically impossible, but anticipated that the first attempt to enforce the bill would almost inevitably lead to a definition prepared by persons much less competent to do so than are the members of the technical professions; consequently it seems best to prepare such a definition, making it the best that the combined abilities of the engineers of the state can prepare, rather than leave it to the courts to make such definition. The definition given in the tentative form for the bill is as follows:

> Professional engineering, architecture and surveying within the meaning of this act embrace and include all branches of the professions of engineering, architecture and surveying, other than military engineering. Any person who assumes responsible charge in the design or preparation of drawings for any building, bridge, railroad, harbor, canal, dock, dam, waterway, street, highway, sewer, sewage disposal plant, water works, water supply, drainage system, mine, tunnel, dry dock, ship barge, dredge, crane or other floating property, steam engine, turbine, internal combustion engine, or other mechanical apparatus, electrical machinery and apparatus, works for the development, generation, transmission, or application of power, equipment or structures for carrying out mining and chemical operations, refrigerating, heating, or ventilating apparatus or structures, or other works of similar nature which require for their design experience and technical knowledge, or who makes estimates or specifications therefor, or who directs the construction of such works as engineer or architect, or who acts as a consulting engineer or architect, or who surveys or makes maps or plats of any county, township, city, village or of any land, road, lot, sub-division or addition or of any mine, tunnel, stream, or body of water, or who does any work ordinarily known as civil, mining, mechanical, electrical, illuminating, chemical, metallurgical, ceramic, refrigeration, ventilation, heating, automotive, valuation, municipal, highway, railroad, structural, hydraulic, sanitary, irrigation or drainage engineering,, architecture, or marine architecture, landscape engineering or architecture or surveying except on his own property, for his own personal use and without receiving money therefor, or who offers or agrees to do any of the above things, or maintains a place of business for the carrying on of any of the branches of the engineering or architectural professions or surveying, shall be regarded as practicing professional engineering, architecture or surveying within the meaning of this act. Any person doing any of the things specified in this section with authority to use discretion, assume responsibility, and devise methods shall be regarded as practicing professional engineering or architecture within the meaning of this act, even though he be employed by or under the direction of a registered professional engineer or architect.

A fee of $10 is provided for consideration of an application and $25 for the examination of an applicant, with $1 for each certified copy of a certificate.

The making of the examinations and granting of certificates will be the duty of a board appointed by the governor with the consent of the senate. This board will contain eight members, appointed for four years, the terms of four expiring every two years. These members must be registered professional engineers, architects or surveyors, there being at least three professional engineers and three architects, with not more than one member from the same branch of the profession of engineering. Each member must have been for at least five years a citizen of Ohio and continuously engaged for at least ten years in the active practice of one of the three professions or in teaching such profession in a reputable college, not more than one teacher to be a member of the board at any time. No member of the board will receive compensation except the secretary. The affirmative vote of not less than five members will be required to issue or revoke a certificate, and these five shall include a majority of the architectural members for an architect's certificate or the majority of the engineer members for an engineer's or surveyor's certificate. The board may issue certificates without examination to persons holding similar certificates from other states or territories. Any one obtaining such a certificate by fraud or who fraudulently pretends to own such certificate shall be subject to a fine of between $100 and $1,000 or imprisonment between thirty days and one year, or both; while any one practicing engineering, architecture or surveying without a certificate shall be subject to a fine of from $20 to $500, imprisonment between thirty days and one year, or both.

Paving Specifications by Pavement Associations

The Asphalt Association and the National Paving Brick Manufacturers' Association have prepared and published for distribution and use complete sets of specifications, including sub-base, base of macadam, cement and bituminous concrete, and wearing surfaces of brick, asphalt macadam, asphalt concrete and sheet asphalt.

Within the past few days there have been received at this office a complete set of specifications for laying brick pavement, published by the National Paving Brick Manufacturers' Association, and a notice by the Asphalt Association of the publication by it of specifications for the various kinds of pavement using asphalt as a binding material. Both of these associations, while they are maintained by and for the benefit of manufacturers of paving materials, are concerned very largely with insuring the use of such materials in the way which will give the most satisfactory results and thus serve as an advertisement of the material, and it may be assumed therefore that the specifications can be relied upon as calculated to give the best pavements obtainable with the particular materials under discussion.

ASPHALT SPECIFICATIONS

The asphalt specifications are issued in a series of five different parts, dealing, respectively, with asphalt macadam surface course, asphaltic concrete surface course with coarse graded aggregate, asphaltic concrete surface course with fine graded aggregate, sheet asphalt binder and surface course, and asphaltic base. In addition, the association has issued specifications in mimeograph form dealing with asphaltic concrete binder and surface course; gravel base; macadam base; reconstruction of old macadam to serve as base course; Telford base; Portland cement concrete base; truing up old pavements to serve as base course; preparation of sub-grade; sub-base; and shoulders, headers, curbs and gutters. In the preparation of the first five specifications, special attention has been paid to form and arrangement, with the idea of making them definite, concise and free from ambiguities. They are printed on single fold sheets of the size adopted for this purpose by the U. S. Bureau of Public Roads, most of the state highway commissions, and many municipalities.

"During the preparation of these specifications the committee had before it the specifications of every state highway department in the United States as well as those of a large number of the principal counties and cities and of the United States Bureau of Public Roads. The opinions of many prominent highway engineers were obtained and digested. The committee, with Mr. Prevost Hubbard, formerly chief of the Division of Tests and Research of the United States Bureau of Public Roads as chairman, was composed of engineers having long practical experience upon highway and pavement construction and design. In order to make them applicable to varying conditions throughout the United States, each printed specification is accompanied by a notice to engineers which will assist the engineer in modifying it if necessary to meet his particular requirements." We suppose that these specifications may be had upon request of the association, 25 West 43rd street, New York City.

Some of the fundamental features of these specifications are:

For asphalt macadam surface course, a minimum thickness of 2½ inches using 1½ to 2½-inch crushed stone and asphalt of 80 to 150 penetration.

Asphaltic concrete surface course with a thickness of 2 inches consisting of a coarse aggregate 95 per cent of which will pass a 1¼-inch screen for the coarse graded aggregate type, or a ½-inch screen for the fine graded aggregate, 4 to 6 per cent of filler for the coarse aggregate type and 7 to 11 per cent for the fine aggregate; and 5 to 8 per cent of asphalt for the coarse and 7.5 to 9.5 for the fine, the asphalt to have a penetration of 50 to 70.

Sheet asphalt binder and surface course each to have a thickness of 1½ inches, the binder course to have 60 to 80 per cent coarse aggregate, 4 to 6 per cent of bitumen, asphalt cement for both courses to have a penetration of 30 to 60. The surface course to have 10 to 40 per cent of 10-mesh to 40-mesh material, 22 to 45 per cent of 40 to 80-mesh, 12 to 30 per cent of 80-mesh to 200-mesh, and 10 to 20 per cent passing 200-mesh; with 9.5 to 12 per cent bitumen.

Asphalt base to consist of two courses, the first 3¼ inches thick and the second 2½ inches, the first containing 2½ to 3½-inch stone and the second 1¼ to 2½-inch; one application of asphalt at the rate of 1.25 to 1.5 gallons per square yard to be made upon each course and the second course covered with thin layer of ¾ to 1¼-inch stone.

The asphaltic concrete binder and surface courses consist of a 1½-inch course of fine graded aggregate asphaltic concrete wearing surface as specified above, laid over a 1½-inch binder course as specified above.

The specifications for the several constructions of base call for two courses of gravel each not less than 4 inches thick; for two courses of macadam each not less than 3 inches thick; for the reconstruction of old macadam giving a minimum

thickness of 6 inches after completion; for hand-laid 8-inch Telford base, or for a 6-inch Portland cement base mixed 1:3:6.

The specifications for truing up old pavements provide for the use of an asphaltic concrete mixture for this purpose. The specifications named last in the list provide for gravel, water-bound and asphalt macadam shoulders, Portland cement concrete headers, curbs and gutters.

BRICK PAVEMENTS

The specifications for brick pavements are printed in a handsome pamphlet of 200 pages, profusely illustrated with photographs showing the various features of constructing brick pavements. Alternate methods of construction and kinds and variations of material are provided for in the specifications. For instance, specifications cover rolled gravel base, rolled stone base, rolled slag base, stone or slag base with coal-tar binder, concrete base, monolithic type, and reconstructed macadam, gravel or concrete base. Sand bed, stone screenings or granulated slag bedding, or cement-sand bedding (semi-monolithic type), are all specified. Specifications are given for standard size brick and block size brick, both plain wire-cut and the block size with lugs. For joint fillers the alternative is offered of oil asphalt applied by the squeegee method, cement grout, or sand filler. For longitudinal expansion joint (called expansion cushion), both the pre-molded and the poured type are specified.

The specifications include sections for under-draining and grading the sub-grade, mixing and placing concrete as well as testing the materials that enter into it, setting the curbs and headers, both concrete and stone, preparing the base, and all the regular features of brick pavement construction.

The longitudinal expansion cushion is called for only where cement grout filler is used. The pre-molded strips are to be ½ inch thick, and the same thickness is used for the poured cushion. Fully one-half of the specifications are devoted to the base and shoulders of the pavements, which are included under the same heading and for which twelve alternative classes of material and treatment are provided.

The standard size brick is 3 inches by 4 inches by 8½ inches, from which they must not vary more than ⅛ inch in width or depth nor ½ inch in length. The block size is 3½ inches by 4 inches by 8½ inches, with the same limits of variation. Blocks with lugs are 3½ inches by 8½ inches by a depth left unfixed. In the case of the plain wire-cut brick or block, it is provided that brick shall be laid "with the better face or side upward"; this apparently providing for the so-called vertical fiber pavement as well as for the ordinary method of laying.

No advice is given as to the selection of any of the alternatives offered, but the specifications are provided to cover the several types and details of construction which may be preferred by the engineers or be best adapted to local conditions.

Recent Developments in Brick Paving

In a discussion before the American Society for Municipal Improvements, J. C. Travilla, engineer of the Dunn Wire-Cut Lug Brick Co., criticizes some of the changes advocated by brick manufacturers as to lugs, size of brick, and thickness of foundation, and makes suggestions concerning filler, cushion and expansion joints.

Some of the recent developments in brick paving and paving bricks, which were submitted last year to the specifications committee of the A. S. M. I. but not formally acted upon, were discussed at this year's convention of that society by James C. Travilla, consulting engineer of the Dunn Wire-Cut Lug Brick Company and for several years commissioner of streets of St. Louis, Mo. He states that the high cost of brick caused by recent conditions as to labor, materials and transportation has caused some unrest among certain manufacturers, which may be one of the reasons why the National Paving Brick Manufacturers' Association at the 1919 meeting of the A. S. M. I., requested certain amendments to the brick specifications.

"The brick manufacturers, due possibly to lack of co-operation or co-ordination of the industry by limiting the production to a few types of brick, are reported as having twelve different styles of brick for street and highway surfaces." The engineering organizations which have been studying and developing paving specifications have recommended but two types of brick for pavements, and these have been adopted by municipal and state highway engineers generally. "The brick manufacturers should realize that they are merchandising their plant output through engineers who represent the taxpayers, and that any request to change the size and types of brick and amend specifications to meet changed commercial and economic conditions that affect the industry should be based on definite technical information proved by experience." Mr. Travilla recognized the need of variation in the designs and specifications for pavements depending upon local con-

ditions, but questioned the advisability of attempting to adopt them as standards.

LUGS

The author traces the history of paving brick from the original plain wire-cut brick of 1870 through the various changes. With the introduction of tar or cement fillers came the repressed brick, which was provided with buttons or other projections on the sides to provide a definite and positive joint space to permit the filler to flow to the full depth of the brick. These lugs became generally used and adopted as a standard. The rounded edges of repressed brick were found objectionable in maintaining the cement grout filler in the joint flush with the top of the brick; also in repressing, the buttons or projections frequently were deformed so as not to serve their purpose. To eliminate these features, the wire-cut lug brick was introduced in 1910 and has been adopted as one of the standard types by many city engineers and organizations.

"A lugless paving brick has been advanced and promoted on the theory of commercial and economic advantage to the paving industry without due regard to past experience or the engineering features necessary to construct a brick pavement according to the best practice."

Mr. Travilla believed that the advocating of or attempting to adopt a type of brick as a standard that does not insure definite and positive joints is a step backward in the art of making brick and in the science of making brick pavements. His reasons for this are that experience and experiments have demonstrated the necessity for definite joint spacing to admit the filler to penetrate the full depth of the brick; that if a bulge on the end of a lugless brick is desirable to provide spacing, it should be self-evident that a definite joint is required on the side of the brick; and that the abandonment by the manufacturers of their previously advocated policy of using lugs on bricks, at a time when engineers are not in a position to experiment, appears to be a serious mistake. "Fortunately for all parties interested, only a limited number of plants are yet making lugless brick."

SIZE OF BRICK

At the Grand Rapids meeting of the A. S. M. I. in 1911 specifications were adopted for a standard size paving block 3½ inches wide, 4 inches deep and 8½ inches long, with lugs on one side not to exceed ¼ inch in height, and the same was adopted in 1912 by the Association for Standardizing Paving Specifications. Engineers generally have adopted this size and type of brick in their specifications and they are recognized as standard at this time. Any material change in the standard size of a brick would cause inconvenience to engineers in the repairing and maintenance of existing brick pavements and undo a great deal of work that it has taken years to accomplish, such as developing the rattler test.

"The paving brick manufacturers in the West in recent years have established a market for a brick 3 inches in depth known as a vertical fibre brick. The bricks are manufactured with bars on the side to provide spacing for the filler. The 3-inch size of the paving brick has never been standardized by the industry or a national organization and there is no question as to the desirability of adopting a definite standard size and test for both the vertical fibre brick and the wire-cut lug brick. The repressed bricks are not manufactured in the 3-inch size."

FILLER

Refined asphalt for filling joints in vertical fibre brick pavements has been used extensively and the results obtained have varied depending upon the quality of the material, its melting point and the skill used in heating and applying it. Some cities have constructed a bituminous mat on the surface of the pavement by using an excess of asphalt; but asphalt will not adhere to the brick except by mechanical bond, and at times peels off. In applying asphalt by the squeegee method the joints are often bridged over, while pouring the asphalt into the joints insures better penetration and the saving in the amount of asphalt used will more than pay the cost of the additional labor. On pavements carrying a large percentage of horse and steel-tire traffic, the filler will cut out of the top of the joints within a few years and should be renewed—a feature of maintenance which is generally overlooked.

"It may be stated as a general proposition that a bituminous filler is best adapted where the wearing surface is laid upon a new macadam or gravel foundation. The cement grout filler is adapted for use where the sub-grade soil is stable and the design provides for a rigid foundation."

FOUNDATION

"For a national engineering organization, under existing truck traffic and pavement failures that have occurred recently, to consider a reduction in the depth of the concrete foundation to permit the use of a slab less than 6 inches in depth, as suggested by certain interests at the New Orleans meeting in 1919, will not meet with the approval of engineers. However, engineers should be sufficiently informed to modify the design of a foundation recognized as standard to meet local conditions.

"It also seems reasonable to suggest that a differential be allowed for the depth of the concrete foundation depending on whether the filler used is cement grout or bitumen; but again, this suggestion or modification of the specifications should be treated as a local proposition not coming within the scope of a national engineering organization."

CUSHION

Fine cement carrying a small amount of loam or silt has not given entirely satisfactory results because of the tendency of the material when moist to work up into the joint spaces when the brick are rolled, thus preventing the filler from penetrating the full depth of the joint. A coarse sand for the bed drains much better than a fine sand and, when prepared by rolling with a light hand roller to acquire uniform density before

striking it with a template, furnishes a bedding course that gives satisfaction.

"Many engineers are using cement and sand mixed, usually 1 cement to 4 sand, spread dry. There seems to be no question but that a greater number of longitudinal cracks appear in a cement grouted brick pavement laid upon a sand bed that does not drain readily than when the bed is a mixture of cement-sand."

EXPANSION JOINTS

Engineers differ as to the advisability of expansion joints at fixed intervals in brick pavements when cement grout filler is used. The author of this paper "questions the advisability of attempting to control temperature stresses with transverse joints. A study of pavements with expansion joints would indicate a weakness in the structure at or near the joints, by reason of contraction and expansion stresses destroying the bond between the courses of brick, and a tendency of the pavement to lift at the joints. . . . A large percentage of the blow-ups that have occurred in grouted brick pavements may be attributed to a defective joint in the end of a day's run or at a break in the street grade." The author believes that each paved street intersection in the line of the improvement may be considered a compression header. If a street intersection is not improved, there should be placed at the beginning or ending of the work a concrete header that will have the same effect, i. e., to confine the stresses within the limits of one city block. The pavement should be completely separated at alley entrances and driveways. Manhole frames and castings should be so set as to permit them to move with the pavement; otherwise expansion cushions should be installed around these appurtenances. Longitudinal expansion joints should be placed adjacent to each curb line.

Size of Paving Blocks

In a paper entitled "Bricks vs. Blocks,'" S. Cameron Corson, Borough Engineer of Norristown, Pa., argued against the use of blocks and in favor of the old standard repressed paving bricks, giving as his reason his personal experience in Norristown. He stated that his borough has been laying brick pavements since 1897 and, although showing signs of wear, these old pavements laid with repressed brick are in excellent condition. On the other hand, pavements laid during recent years of vitrified blocks are being destroyed by longitudinal and transverse cracks, and individual blocks in the middle of the pavement are disintegrating and going to pieces. Mr. Corson believed that the blocks are not so well burned as the bricks and are more likely to be laminated. Broken blocks are found to absorb considerable water and to be not thoroughly burned through.

He also introduced the question of proper thickness for expansion joints. He had found ¾-inch joints reduced to less than one-half that thickness and half of the joint material forced out of the pavement by expansion. He considered that at street intersections with 10-foot radius circular corners, the distance to be used in determining thickness of expansion joints should be the diagonal across corners, and this would be 58 feet for a 36-foot street. The rule used by one agent for pavement filler gave a joint thickness of 3½ inches for each corner or 7 inches in all, which would seem impracticable or at least undesirable.

Massachusetts Highways

At the October 14th meeting of the Massachusetts State Chamber of Commerce John N. Cole, state commissioner of public works, stated that Massachusetts is more dependent on highways than any other state because of the lack of co-ordination and co-operation of railroads and because of the unsystematic terminal facilities of Boston. It is considered an essential of progress and prosperity that the highway system be reconstructed and the toll charges perhaps reestablished in the interest of greater efficiency. This year the state is spending $4,500,000 on highways and has a budget for next year of $7,000,000.

Last year the bids for construction were from 24 to 34 per cent above the unit price estimate, while this year every bid submitted has been below the commission's unit price estimate. An explanation of this fact was illustrated by the replies of two contractors who agreed that it was because of the decreasing cost of labor and materials; one of them, an Italian, stating that "to day I say to the workmen 'you take that pick and dig or I smash your head,' while before when told to work, the laborer replied 'you shut up or I smash your head.'" This was assumed to mean that labor was now getting ready to do a day's work.

An important item of the high cost of highways in Massachusetts is the expense for bridges, less than 10 per cent of which are stated to be adequate for their daily loads, necessitating an expenditure of $30,000,000 for their reconstruction in the near future.

Winter Work on Gravel Roads

Road contractors in Montana have been notified by the State Highway Commission to observe the following conditions in connection with road work during the fall and winter: Preliminary work must be completed long enough before freezing weather to eliminate the handling or movement of frozen earth. Drainage structures and ditches must be complete and in operation before placing surface gravel. Gravel may be hauled during the winter except where such hauling creates cuts or ruts to such an extent as to prevent reshaping. All snow must be removed before placing surface gravel. "Early in the spring, as soon as weather permits, contractors will thoroughly disturb the mass of gravel, by scarifying with a heavy spike-tooth harrow, remove over-size stones and complete work as specified." It is thought probable that considerable gravel hauling will be done this winter under these regulations.

Delaware State Highway Department

Organized under recent legislation, this department has adopted up-to-date methods and policy, after making comparative study of highway departments of other states. Counties receive state and federal aid. The state system provides main north and south highways with transverse connections having unusually straight alignment and avoiding passing through towns.

The state of Delaware is 110 miles long and 35 miles wide and contains 2,370 square miles. The highest point is 60 feet above sea level and the surface is so level that drainage is difficult in many places. The greater part of the soil is sand or sandy clay and there is little rock suitable for paving. For four months of the year there is sufficient low temperature to prevent concreting, but there is little snow. The roads outside of the cities total 3,796 miles, of which, at the beginning of this year, only about 400 miles had been improved, 300 of these being penetration macadam, 90 miles concrete 14 to 18 feet wide and 7 miles brick 19 to 40 feet wide.

Until 1917 there had been no state highway department or state control of highways, although a number of progressive citizens had been urging that such be established.

1911 the General Assembly passed the Boulevard Corporation act authorizing a corporation of private citizens to build a state road, which, after completion, was to be conveyed to the state free of cost and the state must forever maintain the road and its bridges, culverts, etc. Under this permissive act the DuPont Boulevard Corporation was formed. A twenty-mile right-of-way between the Maryland line and Georgetown was acquired and a concrete road constructed on it, following which another section of road was begun and, in spite of litigation, was completed in 1917. The road so constructed was formally turned over to the state three months after the formation of the State Highway Department.

STATE HIGHWAY DEPARTMENT CREATED

In 1917 the General Assembly enacted a law creating a State Highway Department to establish a permanent system of highways, with power to take over any existing roads and convert them into state highways.

The department was organized in June, 1917 with Governor Townsend as chairman and four other citizens, including T. Coleman DuPont, who had been president of the DuPont Boulevard Corporation. Chas. M. Upham was employed as chief engineer. Mr. Upham had been chief engineer of the DuPont Boulevard Corporation for two years and met the requirements of the law that the chief engineer must be a civil engineer at least 30 years old who has been in active practice of his profession for ten years and has had responsible charge of road engineering work for 5 years and be qualified to design as well as to direct engineering work. Graduation from a recognized school of engineering is considered equivalent to two years of actual practice.

Chief engineer Upham studied the road systems of several other states, including Pennsylvania, Maryland, New York and Massachusetts, preparatory to determining the policy of the new department. It was decided that the state should maintain only those roads which it constructed, concentrating its resources upon those where maintenence would be profitable, a survey having showed that thousands of miles of roads in this state were sadly out of repair.

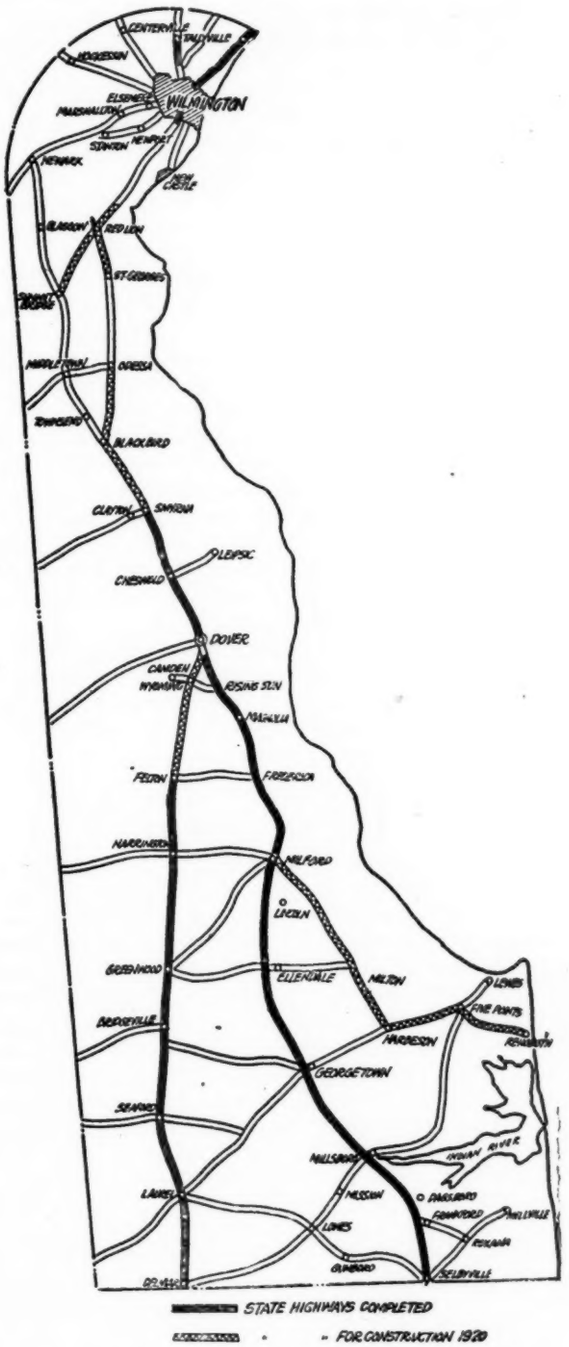
The state system was outlined to consist of a north and south trunk line system to supplement the country roads running east and west, with a radial system around the principal city of Wilmington. This involved approximately 270 miles.

The construction program for 1917-18 was centered upon the roads carrying the greatest traffic and suffering the worst physical conditions. In spite of war conditions, in the first 18 months over 280 miles of road were surveyed, 190 miles plotted to a small scale and detail plans made of 130 miles, while excellent progress was made in carrying out the tentative program of 40 miles of construction.

Instead of following the old country roads, as had at first been contemplated, these were found to be so winding that the effort was finally abandoned entirely and the state roads were laid out unusually straight, tangents generally being several miles long connected by long-radius curves. The flat topography permitted this and also very light grades. In order to avoid land costs, damages and condemnations and to prevent local traffic from interfering with through traffic, the roads generally avoid towns keeping about a mile or one-half mile from the town limits.

Immediately after the organization of the State Highway Department it commenced a survey of the state to locate deposits of sand, gravel and stone suitable for highway work. It found no gravel or stone except in the northern part of the state and,

although there is abundance of clay, it is not acceptable for road work. The department is using the entire output of quarries at the northern end of the state but this is by no means sufficient and broken stone was imported this season at a cost of $1.50 to $1.75 per net ton at the quarries, plus 90 cents freight to Wilmington up to $1.40 freight to the southern end of the state. About 85 per cent of the sand is purchased by the contractors from dealers, 15 per cent at 60 cents per ton from a pit at Lewes and the balance from Maryland or from Delaware river dredgers.



CONSTRUCTION PROGRESS ON DELAWARE STATE ROADS

1919 LEGISLATION

In 1919 the department had a state law passed limiting to 26,000 pounds the gross weight of any vehicle and load operated on Delaware roads, and to 6,000 pounds the gross weight of trailers with metal tires, and giving the State Highway Department police power to enforce this and other acts regulating highway traffic. Traffic officers of the highway department are stationed at important points and do not only control speed but prevent the use of the roads by improper vehicles and excessive loads.

The 1919 legislature also provided that the highway department offer each year not less than $100,000 to each of the three counties, which are to appropriate as much as they receive from the state and also $100 per mile annually for the maintenance of the state-aid roads. These roads are east and west roads. Kent county last year authorized $100,000 and Sussex county $250,000. In 1920 the department set aside $750,000 for aid to the counties.

TYPE AND CONSTRUCTION

Except for one road, the Philadelphia Pike which is paved with brick, the standard adopted was concrete pavement 14 to 18 feet wide and mixed 1 cement, 2 sand, 4 stone, and 0.1 hydrated lime, as specified by the American Society for Testing Materials. It is finished with a roller 6 feet long weighing 60 pounds, and a bow-belt. Joints are provided only at the end of each day's work. Four rods dipped in asphalt and extending 2 feet into each slab are placed at each joint and no bituminous filler is used. The concrete is required to stand at least 28 days before the road is open to traffic. In one and a half years since the first of these were constructed the maintenance cost has been $3,300 for 30 miles.

In 1920 there were under contract 147 miles of roads including unfinished 1919 contracts, and 100 miles more were projected. Construction was greatly hindered by difficulty of securing cement. By June 21st, only about 40 miles of concrete highway had been placed under construction and it seemed impracticable to consider beginning any more, but no difficulty was experienced in securing asphalt and stone shipments. At a conference held on this date, it was, therefore, agreed that the program should not be held up but that the pavements should be constructed of an asphalt wearing surface on a bituminous foundation for the remaining 40 miles of the year's program. Also, a smaller experiment consisting of approximately 15 miles of asphalt surface road was tried out in Sussex county with good results.

The general policy was adopted of letting contracts in sections 4 to 6 miles long in order to encourage contractors to use efficient equipment and organization and secure low prices. Roads were built in 1918 at $36,000 a mile, in 1919 at $32,000, and in 1920 at $47,000. The labor available is mostly colored and although scarce, suffices and gives fair results for a wage, last summer, of about 40 cents an hour.

Engineering Activities of the Illinois Health Dept.

These include general supervision over water supplies and purification, sewerage and sewage treatment, stream pollution and public sanitation. It aims to assist engineers engaged in such work in that state.

A very important part of the work of the Department of Public Health of the State of Illinois is performed by the Division of Engineering and Sanitation, generally referred to as the Division of Engineering. The work of this division includes:

1. Control of installation of water supply and sewer systems, including water-purification plants and sewage-treatment plants. Examination and approval of plans for all such installations.
2. Studies of stream pollution.
3. Sanitary surveys.
4. Supervision over sanitation of common carriers, including sources and handling of water supplies.
5. Sanitary inspections of public school buildings.
6. Malaria control by mosquito eradication.
7. Studies of city waste collection and disposal and street cleaning.
8. Investigations of typhoid fever and other diseases that may be water-borne.
9. Public addresses on sanitary engineering topics.
10. Informal advice by correspondence on sanitary matters.

Because of the limited staff, it has not been possible to carry on some of these activities as thoroughly as desirable, but special attention has been given to water supply and sewerage work. Examinations have been made of nearly all existing public water supply and sewer systems, preliminary investigations and studies have been made in many communities where they should be installed, and detailed descriptive reports have been prepared of all these investigations.

It is the aim of the division to be of the greatest possible assistance to engineers of the state who may be engaged in water supply, sewerage or other sanitary work, and it is endeavoring to call the attention of all such engineers to the aid which it can give them. All the reports and information gathered by the division are available, and additional investigations can be made by the division to aid engineers who have been employed by communities to make studies or prepare plans and specifications for public improvements. There has been some criticism that the division takes the place of consulting engineers, but it maintains that, on the other hand, it always encourages the employment of competent consulting engineers by communities, and then endeavors to assist the engineer as far as its authority and duties will permit. Experience has shown that this service has been very beneficial to both engineers and communities.

The control given the division over installing or improving water supply and sewer systems has, it believes, been beneficial to the engineers because communities as a rule are more favorable to carrying out such public improvements if they are assured that such improvements have been carefully studied and plans approved by a state department. Moreover, when the plans have been approved by the division, it can often be helptul in influencing the community to take definite action when it shows a tendency to postpone any such action indefinitely.

The division recommends to communities that they employ competent engineers whenever water supply or sewerage work is contemplated, but does not suggest the names of engineers, even when requested to do so by municipal officials. On the other hand, the division will furnish to engineers, on request, information relative to any particular municipality where water supply or sewerage or other sanitary work is needed, but does not furnish a general list of places where such improvements are being considered or should be carried out. Every effort is made to have municipalities engage competent engineers when a project is first considered, that they may make studies and prepare preliminary reports with estimates of cost and make definite recommendations; rather than permit the city officials to decide, without having sufficient data before them, what they consider should be done and then engage engineers to design and carry out the work already decided upon.

This work for the engineers and the communities of the state is under the charge of Harry F. Ferguson, chief sanitary engineer, with C. St. Clair Drake, director of public health for Illinois, in general charge of the department.

City Sells Ashes

The city of Fitchburg, Mass., finds a sale for a part of its ashes, although only a small part, to factories in the neighboring town of Leominster, where the dust sifted from the ashes is used in the comb industry. The city received for ashes sold for this purpose $332.25 in 1919. The total cost during the year of collecting both ashes and rubbish (the cost of the two not being kept separate) was $16,959, so that this was only about 2 per cent of the cost. It may offer suggestions, however, for similar uses to which ashes may be put in other districts and other industries.

Millions for Manitoba Highways

The Manitoba government has submitted to the minister of railways and had approved by him plans for highway construction involving the expenditures of about $3,500,000 on 4,000 miles of roadway.

Immigration Notes

The congestion at Ellis Island still continues and the difficulties of the immigration officials due to inadequate force and accommodations are increased by the large amount of rejections that are necessary on account of the large proportion of indigent arrivals and those that are diseased, evil minded, or otherwise undesirable. The proportion of rejections is now more than twice as great as in 1914, and in one month there were 1,757 steerage passengers absolutely destitute, with no money whatever, besides 638 that had less than $20 each. The character and number of undesirables arriving shows that viséing of the passports abroad by American consuls is done without adequate facilities and that inquiry into the physical, mental and financial state of the applicant is practically nominal. It is to be hoped that the present price of steerage transportation, which is about $110 as against $25 before the war, may operate in some degree to secure more desirable immigrants.

One of the difficulties due to the infficiency of the Ellis Island immigration office is that since October, 1918, the issuance of certificates of arrival and papers for candidates for citizenship has been neglected so that at present there are 616,400 in arrears, which, at the present rate, may increase to 100,000 per month.

The number of aliens waiting to depart from the other side for America is apparently increasing. It is now estimated that between 3,000,000 and 4,000,000 Italians and more than 3,000,000 Poles are waiting to come across; 267,000 applications have been made in Poland alone for passports, most of them for Jews. Some Italian farmers say that they are emigrating because of danger from explosions when plowing in former battle grounds. If the present conditions continue, the only limit of immigration for a long time will be the capacity of the steamships.

In New Orleans a committee of eleven, composed of representatives of rice, cane and cotton growers and steamship and railroad officials, has been appointed to devise a practical method of exploiting Louisiana resources with the view to inducing immigrants to plan, before they sail, to come to New Orleans.

A large proportion of immigrants landed in New York are destined for Chicago and vicinity, especially the Calumet district, while many have tickets through for Denver and other Rocky Mountain points, from which there has been for months a considerable migration back to Europe. Other immigrants continue across the continent to San Francisco, Seattle and Portland.

The enormous wages paid here have been duly exploited abroad and labor naturally is eager to participate in the one dollar per hour rate for unskilled or semi-skilled services. In a group of about 150 in line at the Ellis Island ticket office, 30 were bound for Chicago, 10 for Detroit, 6 for Denver and 6 for San Francisco, the remainder were going singly to a large number of destinations from Florida to Minnesota and from Pittsburg to Sacramento. The distribution is considered much wider than it has been previously for many years.

The willingness of some countries to share their population with us is illustrated by the fact that on October 9 the former "Germanic" of the White Star Line, now owned by a Turkish company and chartered by Greeks, sailed from Constantinople for America carrying 1,000 Greek, Armenian and Jewish immigrants who left without American passports and without the consent of the French authorities in charge of the port.

Advance figures of the immigration report for last year show that 41,594 aliens gave Massachusetts, 32,502 gave California, 28,227 gave Michigan, 13,212 gave Connecticut, 5,698 gave Minnesota and 4,326 gave Florida as their place of destination. In order to secure a better distribution of immigrants, a new bureau is to be established at Ellis Island under charge of P. A. Donohue from the Department of Labor. This bureau will be provided with economic and linguistic experts who will endeavor to counteract the general tendency of immigrants to settle in large cities because they know nothing of other portions of the country. The necessity for this action is emphasized by the fact that within a few days delegations from Detroit and from Akron, Ohio, have visited Ellis Island to endeavor to divert immigration from these municipalities to farm land in northern Michigan and Ohio.

The Labor Department in New York State is cooperating in the effort to secure a better distribution of immigrants throughout the country and to avoid their concentration in large cities. A bureau for this purpose has been established in New York and in most of the large cities throughout the state and billboards are erected displaying notices in many languages that all kinds of skilled and unskilled labor are handled without fees.

In reply to pleas by the immigration service a number of large enterprises throughout the country have written to the commissioner at Ellis Island offering to employ hundred of aliens. Among these companies is the Oliver Coal Company at Daleski, Ohio, that wants several hundred miners at $8.00 per day. There are also many invitations from farming companies.

Notwithstanding an increasing number of undesirable immigrants that are shipped back to Europe because they are penniless, their average prosperity is much greater than before the war. In 1914 the average cash brought into this country by the heads of families or by immigrants traveling alone was $46 while in 1920 it has

risen to $119. They are also better dressed and have better household goods than formerly. In 1913 the immigrant transportation from Denmark to New York was $42 and it is now $173. From Italy it was $39 and is now $372; from Germany $34 and now $1,437; in Austria $39 and now $2,847. These figures, of course, represent the loss through depreciation of foreign currency.

Labor Items

There is in Chicago such an abundance of labor that applicants are being constantly turned away and there is prospect for much unemployment during the winter. Railroads and industrial establishments are reducing their forces, many laborers are arriving from the West, from the Northwest, and from Ohio, and the lodging houses and workmen's hotels are crowded.

A bulletin of the New York State Industrial Commission announces that figures based on the reports of 1,570 manufacturers show that there are 100,000 less workers employed in New York State factories than were employed six months ago, making a total reduction of 7 per cent. The highest employment during the last six months was reached in March, and the decline started in April with a reduction of about 1 per cent, due chiefly to the strike of switchmen. The increase has continued since then at a rate of 1 or 2 per cent per month until the present level of unemployment is about the same as it was about one year ago.

According to the United States Bureau of Labor statistics, 9 out of 14 leading industries in the United States showed a decrease of employment in September, 1920, as compared with September, 1919, while 5 showed an increase.

The eight-hour day is universal for labor in Norway and employers complain that the quantity and quality of labor has depreciated very much in the last few years, while the pay has quadrupled or more, men who received 13.4 cents per hour before the war now receive 56 cents, while men in the building trades, most of whom are employed at piece-work, make as much as $1.07. About $25 a week is considered to be a minimum living wage there for a family of four.

Complaint is made from Germany of the increase of unemployment to a great degree, part of which is attributed to the action of the demobilization commission of Berlin which required the discharge from private employment of workers not dependent on their personal earnings for their livelihood. In opposition to this it is said that the National Government will restrain proprietors of factories from shutting down on account of the high cost of production or lack of market and wage demand. There has been a strong tendency to close plants and export the machinery and equipment to foreign countries, which the labor leaders declare is the employers' sabotage and the communists equally object because it prevents them from taking possession of plant and equipment. The proposed new regulations will require proprietors to communicate with the ministry of economics and have the authorities investigate before closing.

Prison Labor on New York Roads

The prison Survey Committee of New York State, Adolph Lewisohn, chairman, has recommended to Governor Smith that prisoners be used more extensively than at present in road building and other outdoor work. This would not, however, mean unfair competition with private contractors, as the committee favors paying offenders for their labor wages based upon these prevailing in outside work.

At present inmates receive only a cent and a half a day. It is proposed that these wages be increased, and that out of the earnings of prisoners the state take the cost of their maintenance. The remainder would either be sent to the prisoner's dependents or, if he has none, be kept in trust for him until his release.

According to the committee's report, which has just been made public, that body finds that road building "is not only advantageous to the upbuilding and general physical welfare of the prisoner, but advantageous to the state."

"It is a sad commentary on prison life," the report declares, "when one reads such a statement as 'work on the road and on the farm should be given men before being paroled, in order that they may become hardened and get into fine physical trim.' It is as necessary to keep them in good physical trim while they are in prison long before they are paroled, as it is to get them physically hardened just before parole."

Reducing Force Increases Output

A Pennsylvania steel manufacturing plant was operating about two months ago with 100 per cent employees and only producing 68 per cent capacity. In consequence 10 per cent of the men were discharged and production rose to 78 per cent. Another 10 per cent of men were discharged and production rose to 85 per cent capacity. A third 10 per cent reduction of labor has brought the production up to 96 per cent of plant capacity. This is another demonstration of the well known fact that the efficiency of labor has greatly decreased within recent years, and suggests a very practical method of increasing it.

Surveying for Dallas Dam

Surveys are being made on Upper Trinity river under the direction of Major W. J. Powell by two parties, which are investigating possible dam sites for the water works of Dallas, Texas. The city commission recently authorized the expenditure of $18,000 for the completion of this survey, which will be continued for several months yet.

Preliminary work has been commenced on the $30,000,000 Bridge river hydro-electric plant at Sillovet, British Columbia.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Protecting Concrete from Frost Part II*

Heating mixing water and aggregate, and use of anti-freezing solutions.

According to a phamplet on concrete work in cold weather issued by the Portland Cement Association, "the general opinion is that freezing will not injure concrete that has had an opportunity to harden for not less than forty-eight hours under favorable conditions; and as a rule concrete will not show any serious effects from having been frozen once, if, after being thawed out, it is not again allowed to freeze until early hardening is complete. But if, before early hardening is complete, the concrete is allowed to alternately freeze and thaw at short intervals, it will be damaged. When prevailing temperatures during the day are below 45 degrees, they often drop suddenly during the night to freezing or below. Therefore, it is necessary that such a drop be anticipated by heated materials and also that means be provided for protecting the work against freezing."

One of the largest and most successful concrete construction companies in this country issues to its superintendents and foremen a series of instructions expressly devoted to the protection of concrete placed in cold weather, in which it defines as winter work all concrete construction commenced in the fall, or before spring, or at any time that brings its completion in the cold weather; and requires the man in charge to provide in advance for either partial or complete protection of the work as may be necessary, and to make requisition for the necessary supplies required to heat and enclose the structure.

Whenever the weather is cold enough to make frost probable, heating the aggregate and the water before mixing will accelerate the setting of the concrete and improve its strength, and may often suffice, without more expensive precautions, to carry the work safely over night or through brief periods of cold or single frosts. Such provisions should therefore always be made. They may be simple and easily provided at small cost and are certain to be imperative if the cold is great enough or prolonged enough to make it also necessary to enclose the concrete and warm the atmosphere around it.

*Part I, Effect of frost on concrete, was published November 13.

HEATING WATER

For a small amount of work, the water can be heated in kettles over open wood fires; but for work of any magnitude, some continuous system of heating it is desirable. If there is a pipe system for water under pressure, good results may be obtained by running the supply to the mixer through a section of radiator or through any grid-iron or coil of pipes under which an open fire is kept burning.

Any heater like that for a kitchen or laundry, boiler, or a discarded hot water house heater, will answer the purpose if it is more conveniently available. A special heater on the market for this purpose consists of an open sheet-metal box with vertical sides, a fire grate in the bottom and an open fire pot. The fire pot itself consists of a rectangular coil fitting the box and connected to the water supply and automatically heating it as it is drawn off to the concrete mixer. The principle is essentially that of the ordinary range water-back for a kitchen boiler, and the advantage is that the open fire also serves to heat the atmosphere and thus makes the apparatus equivalent to the ordinary brasier or salamander commonly used for heating the atmosphere surrounding concrete under construction.

If steam is available, it can be conveniently used for heating the mixing water. Exhaust steam may suffice, and can be simply turned into a water barrel or tank from the open end of the exhaust pipe.

If live steam is used from the boiler supplying the mixer engine or the hoisting engine or from a special boiler, it can either be circulated through a coil immersed in the water-supply tank or be admitted through pipes closed at the farther end and perforated with small holes which are submerged in the tank and allow the live steam to rapidly heat the water. These devices can be manufactured easily on the job from second-hand pipes.

HEATING THE AGGREGATE

Sand, gravel and broken stone should always be stored in a dry place as near as possible to the mix-

ing machine so that after being warmed, they may lose the minimum amount of heat in transit to the concrete mixer. They should be protected from storm, and if convenient may sometimes be advantageously stored in the finished cellar of the building under construction or in some unused shed that is near by it. If stored in open-air piles, they should always be protected by tarpaulin covers that not only keep off snow and rain but retain the warm atmosphere and prevent excessive radiation of heat.

Small storage piles of aggregate, and piles of aggregate that is constantly received as used may be satisfactorily heated merely by building the piles over a horizontal flue, such, for example, as an old smokestack, a few lengths of vitrified drain pipe, or some built-up brick or stone structure in which a wood or coke fire can be maintained, the flame and smoke passing from end to end of the conduit and heating all of the surface, which radiate into the pile above. The aggregate must be taken from above and pushed over the flue, or if the pile is large it must occasionally be shoveled and shifted so as to better heat the exterior portion.

When steam is available, it may be supplied to short lengths of pipes plugged at the extremity and perforated at frequent intervals with small holes. If these pipes are driven into the pile of sand, gravel or broken stone and live steam turned on it will quickly heat the material. The piles may be placed horizontally in the bottom of the storage pile and left there to keep the mass warm while the aggregate is used from the bottom of the pile and colder aggregate slides down to take its place. In this case the pipes should be perforated on one side and that side turned downward to prevent the holes from becoming clogged with dirt and sand.

For jobs requiring a large amount of aggregate or for work long continued in cold weather, the aggregate may be stored in bins provided with perforated steam pipes permanently installed on the bottom and sides of the bin. In one winter job of concreting an 18 h.p. boiler was installed especially to provide steam for heating the aggregate and the concrete forms, and delivered steam to a horizontal grid-iron consisting of six 36-foot lengths of 1½-inch pipe perforated with 3-16-inch holes 12 inches apart. This pipe was connected up in a rectangular framework on or near the level of the ground and the stone was piled over one end of it and sand over the other end. During the day, when the aggregate was constantly being taken from the piles to the adjacent mixer, the storage piles were kept uncovered, but at night they were covered with canvas and the steam pressure maintained, preventing the materials from getting cold. A 1½-inch branch from the steam main was led to a water barrel from which the supply for the mixer was taken.

There are on the market torches, provided with a blast by which a long flame can be directed to a considerable distance, that are used for heating the materials in the mixer drum while the concrete is being mixed. For this purpose the torch is arranged so that its flame enters the drum near the axis and plays directly on the aggregate while the drum revolves. In this case the inlet and outlet openings on both sides of the drum are usually covered by canvas or some other easily movable protection that helps confine the hot air in the drum. Similar results can also be obtained by letting live steam into the drum while the mixing is in process, but in this case it is well to allow for the moisture condensed from the steam in proportioning the amount of water to be used for mixing the concrete.

It is considered good practice to heat materials so that the concrete will have a temperature of at least 70 degrees when placed in the form. Generally the sand, stone and gravel are not heated to more than 150 degrees, but the water can be heated to any convenient temperature. It is not usually economical to have the material hot enough to give the concrete a temperature of about 90 degrees when discharged from the mixer.

ANTI-FREEZING SOLUTION

When only very light frosts are anticipated, it is sometimes more convenient to prevent freezing by dosing the water rather than by heating it, especially as this method will prevent freezing for a longer time than simply heating the materials before mixing. Common salt dissolved in the mixing water will lower the freezing temperature about 1 degree Fahrenheit for every 1 per cent by weight of salt added. Care should be taken not to use more than an extreme maximum of 10 per cent of salt, because in greater quantities it is likely to injure the quality of the concrete and, in any event, is undesirable because it retards the setting of the concrete.

Better results are obtained by using calcium chloride, which is not only more efficient in preventing freezing, but has a great additional advantage in accelerating the hardening of the concrete and thus reducing the time for which it is necessary to protect it from the cold, besides developing strength more rapidly. Calcium chloride is sold by several commercial dealers under different names such as "quickstone," or by its own name, and they also sell other preparations with various additional ingredients, all of them securing the same results. It can now be purchased in a solution of about 27 per cent at a price of about thirty-five cents per gallon. In one case its use in the construction of a 10-inch wall enabled the work to be continued safely when the temperature was near zero. Caution should, however, be observed in the use of calcium chloride where reinforcement steel is embedded in the concrete because some tests of the Government Testing Bureau have indicated that it caused an increased corrosion of the steel, an effect that was not, however, detected by some other observers.

Houston, Texas, Cannot Pave

Although property owners in Houston, Texas, are willing to pay the entire cost of paving in front of their properties, leaving for the city only the cost of the intersections, the city cannot take advantage of the offer since it has no money in the treasury to pay for such intersections. It is reported that the city could lay 50 miles of new pavement, all to be paid for by property owners, if it could pay for the intersections.

Recent Legal Decisions

TAXES CAN BE LEVIED BEFORE IMPROVEMENT IS COMPLETED IN KANSAS

The Kansas Supreme Court holds, State v. Stewart, 191 Pac. 269, that under the provisions of the state road law, it is not necessary that an improvement shall be completed before general county and township taxes can be levied to provide a fund to meet at maturity the first installment of the bonded debt created therefor, notwithstanding that local assessments upon the land specially benefited cannot be made until such completion.

BUILDING PERMIT ORDINANCE HELD VALID

The Maryland Court of Appeals holds, Farmers' & Planters' Co. v. Mayor, etc., of Salisbury, 111 Atl. 112, that an ordinance prohibiting the erection or repairing of buildings within city limits without the issuance of a building permit from the mayor and council, and specifying the matters to be considered on application for such permit, is valid, being a reasonable exercise of the police power granted to the city by its charter. Such an ordinance cannot confer an unlimited discretion, but this the ordinance did not propose to do. The city's action in refusing to grant a permit for the construction of an addition to a building to be used for the purpose of storing, mixing and bagging fertilizer, taken after careful consideration of letters and petitions of those living in the vicinity of the proposed addition, both for and against the grant, was held not arbitrary.

VALIDITY OF ROAD IMPROVEMENT STATUTE

The Arkansas Supreme Court holds, Nettles v. Hazlewood Road Improvement Dist. No. 2, 223 S. W. 397, that the fact that the drainage district embracing a part of the road district was declared invalid did not prevent the road improvement district commissioners from proceeding with the improvement as authorized by the special statute, as it was not shown that the carrying out of the drainage improvement was essential to the construction of the road improvement.

MUNICIPALITY'S POWER TO USE MACHINERY PURCHASED FOR WATER SYSTEM INCIDENTIALLY FOR ELECTRIC LIGHT SYSTEM

In a suit to restrain a town from carrying out a contract for the purchase of electrical machinery and equipment it was alleged that although the expressed purpose of the town's purchase was for pumping and supplying water to the town, this was only a subterfuge and that the machinery contracted for was purchased for the purpose of installing an electric light plant; that bonds had been voted and sold to construct a waterworks system and the town officials proposed to divert funds so raised to construct an electric lighting system. A municipality in its discretion may authorize its property to be used incidentially for a purpose other than that for which it is primarily purchased or constructed, if the use for incidental purposes does not interfere with the use for the primary purpose. The New Mexico Supreme Court, applying this principle holds, Page v. Town of Gallup, 191 Pac. 460, that if it were true, as the town alleged, that the machinery which it was proposed to install was necessary for the present and reasonably anticipated needs of the town for pumping water, the fact that the town proposed to use the machinery in connection with some other municipal use could not operate to prevent the town from installing the machinery. It was a question of fact, of course, as to whether the machinery in question was necessary for the operation of the water plant, or whether the council in good faith had determined that it was necessary. Judgment for the plaintiff was therefore reversed.

DAMAGES FOR FAILURE TO TILE SEWER ACROSS PRIVATE LAND UNDER CONTRACT

Part of an agreement concerning damages for the construction by a city of a sewer across private land provided that if the sewer should create an open stream to such an extent as to interfere with the use of the land for farming purposes the owner could require the city to tile the water across the land. The South Dakota Supreme Court holds, Hatch v. City of Mt. Vernon, 178 N. W. 931, that this provision came under the arbitration clause in the contract, requiring a demand for arbitration of damages in excess of a certain sum to me made by the landowner within five years of the date of the contract. The landowner could not therefore recover damages from the city for its failure to tile the ditch after the expiration of that time, where no demand for arbitration was made as required.

STATE HIGHWAY COMMISSION NOT A MUNICIPALITY WITHIN MUNICIPAL MECHANIC'S LIEN ACT

The New Jersey Court of Chancery holds, Curtis & Hill Gravel & Sand Co. v. State Highway Commission, 111 Atl. 16, that the provisions of the Municipal Mechanic's Lien Act of 1918 do not apply to labor or materials for the performance of contracts made by the State Highway Commission. The commission is not a "municipality" within the act, but is an alter ego of the state itself.

WHEN RELIEF FROM TAX BILLS TOO LATE AFTER COMPLETION OF WORK

A suit for the cancellation of tax bills issued by the duly constituted authorities of Kansas City against the complainant's property for the construction of certain sewers on the ground that the contract was not let to the lowest bidder, no complaint having been made until after the completion of the work, was denied, Welch v. Commerce Trust Co., (Mo.) 223 S. W. 768, where the irregularities charged were in great part matters of public record, and the slightest attention on the part of plaintiff would have disclosed to them all that the parties charged with bad faith knew and they made no objection or protest.

NEWS OF THE SOCIETIES

Nov. 30—NATIONAL CONFERENCE OF HEALTH OFFICERS. Dr. Henry F. Vaughan, Detroit, Mich.

Dec. 6-9—INDUSTRIAL SAFETY CONGRESS. State Industrial Commission. Syracuse, N. Y.

Dec. 8-10—NATIONAL RIVERS & HARBORS CONGRESS. Annual convention. Washington, D. C.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, New York. Secretary, 29 W. 39th St., New York City.

Dec. 9—THE BROOKLYN ENGINEERS' CLUB. Annual Meeting, election of officers.

Dec. 13-16—AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. Annual convention. Washington, D. C.

Dec. 16-17—THE KANSAS ENGINEERING SOCIETY. Annual meeting. Topeka, Kansas.

Jan. 19 — AMERICAN SOCIETY CIVIL ENGINEERS. New York City.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

Jan. 25-27—ASSOCIATED GENERAL CONTRACTORS OF AMERICA. Annual convention. Washington, D. C.; New Orleans.

Feb. 7—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual convention. Coliseum, Chicago. E. L. Powers, 11 Waverly Place, New York City.

May 17-19, 1921—NATIONAL FIREMEN'S ASSOCIATION. Twenty-third annual convention Fort Wayne, Ind.

June 7-9, 1921—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting, San Francisco, Cal.

June, 1921 — CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS, State of N. Y. 12th Annual Conference. Elmira, N. Y.

NEW YORK SECTION AMERICAN SOCIETY OF CIVIL ENGINEERS

At the regular business meeting November 17, the subject of "Urban and Suburban Passenger Transportation" was discussed. Henry M. Brinckerhoff, of Parsons, Klapp, Brinckerhoff & Douglas, consulting engineers, introducing the subject, discussion of which was invited from:

D. L. Turner, chief engineer, Transit Commission.

Frank Hedley, president and general manager, Interboro Rapid Transit Co.

W. S. Menden, general manager, Brooklyn Rapid Transit Co.

R. E. Danforth, vice-president and general manager, Public Service Railway, Newark, N. J.

P. H. Woodward, general passenger agent, Long Island Railroad. R. S. Parsons, general manager, Erie Railroad.

Delos F. Wilcox, public utilities expert.

George McAneny, formerly president of the Board of Aldermen, New York City.

O. B. Wilcox, vice-president, Bonbright & Co.

J. V. Davies, of Jacobs & Davies, consulting engineers.

L. B. Stillwell, consulting engineer.

Frank J. Sprague, past-president, American Institute of Electrical Engineers.

BROOKLYN ENGINEERS CLUB

A regular meeting was held in the club house, 117 Remsen street, on Thursday, October 11, at 8:30 p. m. Paper No. 170, entitled: "City Planning for the Borough of Queens," was presented by Charles U. Powell, chief engineer of the Topographical Bureau, Borough of Queens, N. Y., who discussed and illustrated with lantern slides, the history of the borough plan from the time of its first consideration; controlling elements which determined the borough plan; methods used in carrying out the plan; method of distribution of expense; and the various problems met.

Proximate meetings and papers are: November 18, "Industrial Brooklyn, Paper No. 2," will be presented by Mr. Walter Pfaendler, engineer for the E. W. Bliss Co. December 2, subject to be announced later. December 9, annual meeting of the club and election of officers for the new year.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The importance of transportation is to be given prominence at the forty-first annual meeting of this society, which is to be held in New York City December 7-10.

Daniel Willard, president of the Baltimore & Ohio Railroad and chairman of the Association of Railway Executives, will present statistics on the railroad situation; Charles A. Morse, chief engineer of the Chicago, Rock Island & Pacific Railroad, will discuss the development of railroad feeders; Col. William Barclay Parsons will speak on the importance of freight handling at the terminals and the arrangement of terminals themselves; Gustav Lindenthal, who has prepared a project for the solution of the New York freight problem, will present his views on this subject.

Francis W. Davis, transportation engineer of the Pierce-Arrow Motor Car Company, will discuss the motor truck for long-distance transportation.

Major-General Frank T. Hines, chief of embarkation during the war, will speak on the importance of waterways in transportation.

TENTATIVE PROGRAM

Monday morning, December 6—Conference of Local Sections' Delegates.

Meeting of Committee on Power Test Code.

Tuesday afternoon, December 7 (Simultaneous Sessions)—Fuel Section, Forest Products, Machine Shop Section.

Tuesday evening, December 7—Report of tellers of election and introduction of president-elect, presidential address, conferring of six honorary memberships, presidential reception and dance.

Wednesday morning, December 8—Business meeting. Amendments to the constitution, reports of standing committees, committee on code of ethics, industrial relations, education, feedwater heater standardization, sub-committee on bearing metals.

Wednesday afternoon, December 8 (Simultaneous Sessions) — Management section, railroad section, research —1. Meeting of committee of standardization of plain limit gages.

Wednesday evening, December 8—Oration on the life and work of the late Dr. John A. Brashear, past-president, A. S. M. E., will be delivered by Dr. Henry S. Pritchett, president of the Carnegie Foundation for the Advancement of Teaching.

Thursday morning, December 9—Keynote session on transportation. Railroads, Daniel E. Willard, president Baltimore & Ohio Railroad. Railroad Feeders, Charles A. Morse, chief engineer, Chicago, Rock Island & Pacific Railroad. Waterways, General Frank T. Hines. Motor truck transportation, Francis W. Davis, engineer, Pierce-Arrow Motor Car Company.

Meeting of committee on standardization of shafting.

Thursday afternoon, December 9—Keynote session continued.

Terminals, Col. William Barclay Parsons, consulting engineer of New York City.

The New York Terminal Problem, Gustav Lindenthal, consulting engineer of New York City.

Professional Session, Research—2. Effect of Fittings on Flow of Fluids, through Pipe Lines, D. E. Foster; Steam Formulas, R. C. H. Heck; Organization meeting of the Ordnance Section. Ladies' tea and dance.

Friday morning, December 10 (Simultaneous Sessions)—Design—2, Textile Section, Power Section.

The thirty-eight local sections of the society will each send delegates to the Sections Conference, which will be held this year on Monday instead of on Tuesday, as in previous years. The delegates to the conference select the nominating committee of the society and in other ways serve to bring the point of view of the membership throughout the country to council members and to the meeting.

AMERICAN ROAD BUILDERS' ASSOCIATION

The annual meeting was held November 15 at the Automobile Club of America, New York City. Routine business was transacted. Reports of committees and officers were received, and nearly 100 members and guests attended a dinner followed by several short addresses on pertinent topics.

The officers elected were: President, M. A. Faherty, chairman Board of Local Improvements, Chicago, Ill. Vice-president, Northeastern District, J. A. Duchastel, city engineer, Outremont, Canada. Vice-president, Southern District, Lt.-Col. H. L. Bowlby, chief, War Materials Division, Bureau of Public Works, Washington, D. C. Vice-

president, Central District, Robert C. Terrell, State Engineer of Oklahoma, Oklahoma City, Okla. Vice-president, Western District, S. Benson, chairman, Oregon State Highway Commission, Portland, Ore. Secretary, E. L. Powers, editor, *Good Roads,* New York, N. Y. Treasurer, Senator James H. MacDonald, former State Highway Commissioner of Connecticut, New Haven, Conn. Directors for three years, Northeastern District, Irving W. Patterson, chief engineer, State Board of Public Roads, Providence, R. I.; William R. Smith, president, Lane Construction Corp., Meriden, Conn.; John Swan, Director of Public Works, Pittsburgh, Pa.; Southern District, J. H. Cranford, president, the Cranford Paving Co., Washington, D. C.; W. G. Sucro, County Roads Engineer, Baltimore county, Towson, Md.; Central District, W. A. McLean, Deputy Minister of Highways, Province of Ontario, Toronto, Ont., Canada; Western District, Austin B. Fletcher, State Highway Engineer of California, Sacramento, Cal.

The first speaker after the dinner was the new president, M. J. Faherty, who outlined the great road-building plans of the state of Illinois and the city of Chicago. Mr. Faherty has been very active in securing good roads for Illinois and expressed the desire to have the state project even greater highway improvements than now planned. He assured the members that he would arouse the interest and co-operation of state and city officials in the Chicago convention.

H. G. Shirley, secretary of the Federal Highway Council, spoke upon the urgent need of research in highway work. Foundations, sub-grades and surfacing materials are as yet little understood and money ought to be set aside to investigate these problems. He also pointed out that many states have not as great wealth as has the state of Illinois, hence the construction of highways by the Federal government will do much in aiding the good roads movement in these states.

D. C. Fenner, representing the National Automobile Chamber of Commerce, discussed the road problem from the standpoint of the motor vehicle owner, saying that sharp curves should be eliminated, grades should not be more than 5 per cent and all bridges should be able to support 20 tons. More attention, the speaker said, should be paid to the matter of securing adequate foundations, instead of trying to spread the money out over large mileage with inadequate foundations.

W. E. Albig, of the United States Chamber of Commerce, spoke upon the relation of transportation to the progress of a community, pointing out that good roads greatly facilitate the distribution of food products.

T. W. Dieckman, of the Lakewood Engineering Company, spoke upon the desirability of moving road materials in winter when more open top cars were available than in the summer. By getting road materials on the job in the winter and early spring, road work would not be subjected to the costly delays arising from a shortage of materials due to railroad congestion.

PERSONALS

Weightman, Hugh E., industrial engineer and architect, has changed the firm name to Weightman & Steigeley. The offices are located at 21 North La Salle street, Chicago, Ill.

Alexander, O. M., engineer on heating, ventilating, sanitation, power plant equipment and electricity, has opened a branch office in the Slavic Ban Bldg., Hazelton, Pa.

The American Engineering Co., Philadelphia, has opened an office in Cincinnati, with M. M. Masson in charge.

Birdseye, C. H., chief geographer of the U. S. Geological Survey, has made arrangements with the district engineer of the Corps of Engineers at Chattanooga for co-operative work on the survey which is to be made of the Tennessee river basin.

Copp, Walter P., has been appointed professor of engineering at Dalhousie University, Halifax.

Freyn, Brassert & Co., Chicago, have been appointed consulting engineers for the Royal Netherland Blast Furnace anl Steel Works Company, The Hague, Holland.

Golsan, Page, consulting engineer, is to be connected with the firm of Ford, Bacon & Davis, New York City.

C. W. Hunt Engineering Corporation has been organized to take over the interests of the Hunt products and all engineering business previously performed by the C. W. Hunt Co., Inc., New York.

Ingemanson, T. W., is in charge of concrete road construction with the Iowa State Highway Commission.

Asbury, E. P., has been appointed engineer of Collin county, Texas.

Baldock, R. H., has been appointed division engineer of the Oregon State Highway Department, with headquarters at Pendleton.

Bennett, M. O., has resigned as division engineer of the Oregon State Highway Department.

Chester, The J. N., Engineers, announce the admittance of E. E. Bankson as a partner.

Crockett, J. B., formerly engineer of Collin county, Texas, is to enter the contracting business.

Creer, A. D., and MacKenzie, A. R., civil engineers, specializing in water supply, sewerage, irrigation and other activities, have opened an office in the Metropolitan Bldg., Vancouver, B. C., Canada.

Everham, Co. A. E., of the Engineer's Club, Kansas City, has been appointed a member of the building code committee, Chamber of Commerce, of that city.

Holmes, J. Albert, has been appointed resident engineer for Pearse & Greeley, hydraulic and sanitary engineers, Chicago.

Henderson, Charles E., has been appointed division engineer at Detroit, for the Morris Knowles Co., Inc.

Lamb, Richard, construction engineer, died in New York City October 19.

Mandigo, Clark R., and Prince, John, of the Engineers' Club, Kansas City, have been appointed on that city's Chamber of Commerce committee for city planning and building.

Meeker, R. A., has been appointed executive head of the Right of Way Bureau of the New Jersey State Highway Department.

Newcomb, Clive Seymour, formerly with the Dorr Company, has accepted a position as consulting engineer with the Mutual Chemical Company and the Phosphate Co.

Newell, F. H., connected with the civil engineering department of the University of Illinois, has been appointed director of field forces by the American Association of Engineers.

Anderson, G. E., formerly assistant eastern sales manager of the Duff Mfg. Co., Pittsburgh, has been promoted to southwestern sales manager in charge of the new branch office in the Railway Exchange Bldg., St. Louis, Mo.

Wilson, L. C., for the past two years general sales manager of the Chain Belt Company of Milwaukee, has been elected secretary of the Federal Malleable Company, West Allis, Wis., manufacturers of malleable castings, malleable chain and the rapid molding machine. He will be succeeded as sales manager at the Chain Belt Company by Clifford F. Messinger.

ENGINEER GOVERNOR FOR VERMONT

James Hartness, governor-elect of Vermont, is past-president of the American Society of Mechanical Engineers. The industrial growth of Springfield is said to be due in a large part to his untiring efforts. Mr. Hartness was one of the organizers of the Jones & Lamson Machine Company in that city over thirty years ago.

INDUSTRIAL NOTES

PORTLAND CEMENT ASSOCIATION OPENS VANCOUVER OFFICE

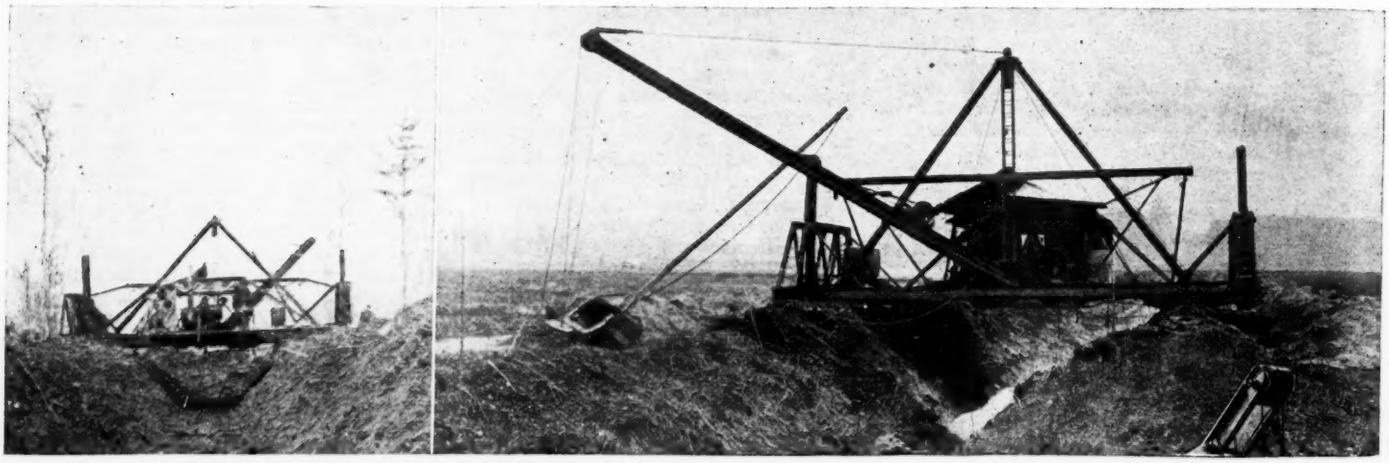
The Portland Cement Association announces the opening of a Canadian office in the Birks building, 718 Granville street, Vancouver, B. C., in charge of A. E. Foreman as district engineer. Mr. Foreman is president of the Canadian Good Roads Association and has just resigned as chief engineer of the Department of Public Works of Victoria, B. C.

GOOD MOTOR TRUCK PERFORMANCE

A round trip of 86 miles one day and 300 miles the following day is regularly made by a 3-ton four-wheel drive truck operated by the Salts Textile Manufacturing Company, Bridgeport, Conn. Alternate trips are made between Bridgeport and New York City and Bridgeport and Philadelphia. There are two drivers, one man responsible for the truck, while the other acts as assitant. On the 300-mile trip between Bridgeport and Philadelphia the men take turns driving. The truck leaves Bridgeport about five o'clock in the morning and returns about six the same evening.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



WALKING SAND DREDGES ADVANCING WITHOUT TRACKS OR FLOATING AND EXCAVATING LARGE DITCHES IN SOFT GROUND

BAY CITY LAND DREDGES

The land dredges, built by the Bay City Dredge Works, are designed for all kinds of work, from narrow, shallow trenches to ditches with a top width of 50 feet, for cleaning out those ditches, and to provide a strong, lightweight, easily portable, economically operated machine efficient for a large variety of work. The dredges are of steel construction, light, strong, easily and quickly dismantled, moved and reassembled. All of them are equipped with an oil-burning engine and can be handled by one man, who is able to dig to the exact required cross-section.

The dredges span the ditch up to a width of 55 feet, excavate to a uniform bottom and side slope, and give wide, clean berms. They can be worked either up stream or down stream, and are provided with a quick-operating self-propelling device.

The walking dredge, which moves ahead under its own power without loss of time, will walk over rocks, swamp or slippery ground and among close-cut stumps where other types of earth excavators find it difficult to work. They are built of ½-yard and 1-yard capacity with clear spans or widths of 14 feet to 38 feet and booms 26 feet to 45 feet long. The walking motion is accomplished by lifting the dredge and shifting its weight from skids that support it while digging to auxiliary skids and then pulling the dredge ahead on rollers on tracks on the auxiliary skids. It requires from 25 to 40 seconds to move the dredge up to the work. It can be moved from one ditch to another at the rate of 16 to 25 feet per minute. It can readily be steered right or left and can move forward or back.

The track type land dredges are of the same general construction as the walking dredges but are carried on steel swiveling trucks operated on track sections that are shifted by the dredge from front to rear as the machine advances. They are built of ½-yard and 1-yard capacity with booms of 14 to 66 feet. Bay City dredges can easily be converted into floating dredges mounted on a single scow or on multiple pontoons. The different types of dredges and their installations on important jobs of varying character are illustrated in Catalog C, which contains testimonials from users of this plant. It also illustrates and describes the Bay City gravel loader, of the same general design and construction as the land dredge, which is used for stripping and grading, loading sand, gravel and clay from banks or pits into wagons. They are built of ½-yard and 1-yard capacity. The former machine has loaded from 400 to 600 yards of gravel from banks to cars in 10 hours.

HOLT CATERPILLAR TRACTORS

Caterpillar tractors built by the Holt Manufacturing Company are satisfactorily used by Sumper county, Georgia, for operating a 4-ton machine, a 5-ton and a 10-ton machine. The 10-ton machine hauling the Adams leaning-wheel 10-foot grader does the work of 32 mules, and the 4-ton machine pulling one 10-foot and one 8-foot Adams leaning-wheel grader does the work of 24 mules. The 5-ton tractor, used for road maintenance work, hauls the Adams road maintainer, with a chain of drags that cover the whole road at one operation and can do 30 miles single or 60 miles double in 10 hours.

TEN-TON TRACTOR HAULING LAND LEVELLER

The daily cost of operating a 10-ton tractor, including interest on investment, depreciation, wages, supplies and repairs is fixed at $35.87. For the 4-ton tractor the cost is $33.40, while the daily cost of the 56 mules that would be required to replace the two tractors is computed at $160.29, showing a balance of $69.27 in favor of the tractors.

The 5-ton tractor operates for $25.08 per day as compared with $64.24 for the mules, showing a saving of $39.76 per day or a saving of $1.32 per mile of road maintained by the caterpillar.